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ABSTRACT

This evaluation sought to determine the impact on students of the materials developed for Project Learning Tree (PLT). Three grade groupings were analyzed: (1) elementary (grades 4-6); (2) intermediate (grades 7-9); and (3) high school (grades 10-12). The basic design consisted of a treatment versus control group using a posttest designed to measure the various components of the PLT materials. Participation required covering a specific set of core lessons with the students and administering a test at the end of the lesson exposure. Approximately 4000 students participated in the evaluation. The results indicated that PLT materials had the greatest impact on intermediate students, especially in the transmission of specific information. A number of puzzling results at the elementary grade level are reported. Included in the appendices are: the selected core lessons, breakdown of the student population by grade and state, test instruments, lists of participants by city and state, and the results on each individual item in the test. (BT)

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BUREAU OF

SCHOOL SERVICE AND RESEARCH

PROJECT LEARNING TREE

Independent Study and Evaluation

UNIVERSITY OF WASHINGTON,

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PROJECT LEARNING TREE

Independent Study and Evaluation

INTRODUCTION

Several areas of evaluation are possible with curriculum materials. These revolve around the questions of exposure, implementation, acceptance and impact. The specific questions which were first considered as a possible evaluation of Project Learning Tree (PLT) materials included:

1) How many teachers had been exposed to the materials?

2) Of those teachers, how many had decided to use the materials in the classroom?

3) How satisfied with the materials were the teachers who used them?

4) What effect did the materials have on students' knowledge, interest and attitudes?

In negotiation with the PLT Advisory Board, it was decided that the Bureau of School Service and Research (BSSR) at the University of Washington would concentrate on the fourth question dealing with student outcomes. Data relevant to the other questions would be collected and summarized by the PLT staff. The evaluation design and results presented in this report deal with the student outcomes.

The first decision concerning the evaluation dealt with what constituted a PLT student. With 82 lessons in the PLT Supplementary Curriculum Guide for elementary students (Kindergarten through grade 6) and 78 lessons in the Guide

for secondary students (grades 7 through 12), it was conceivable that no two classrooms exposed to the PLT materials would have any common experiences. This would make the creation of single test instruments to measure all of these lessons very difficult. Rather than allowing teachers who would be in the "treated" group the choice of whatever lessons they wished, a standard set of lessons was chosen which would be used by all teachers involved in the evaluation. The lessons were chosen to represent a cross section of the principles and activity types as presented in the PLT workbook.

Six lessons were selected for the elementary grades. These were lessons 24, 26, 40, 44, 65 and 78. The five secondary lessons chosen were lessons 2, 3, 6, 14 and 28. In order to be considered a part of the PLT evaluation, the teachers agreed to cover all of the required lessons for their grade level. The teachers were free to expand exposure to the PLT materials by including other lessons, but they could not delete or substitute for the standard lessons. While the choice of these particular lessons involved some subjectivity, it also provided a common experience whose impact could be evaluated. Since these particular lessons were selected to be representative, it was assumed that the results for this set of lessons can be generalized to other lesson sets. [Copies of each of the selected elementary lessons are included in this report as Appendix A and copies of the selected secondary lessons are included as Appendix B.]

RESEARCH DESIGN

The research design consisted of a post-test only with a "treatment" group and a "control" group. The treatment group consisted of students within classrooms where the teacher volunteered to present the chosen core lessons to his/her class and then administer the appropriate test instrument for the class. The control group consisted of students from classrooms where the teacher agreed to give the test without having done any of the PLT lessons or attending the PLT workshop.

The post-test-only design was chosen because:

1) The logistics of obtaining pre-tests and matching the pre-test with a post-test score were prohibitive.

2) The pre-test would provide a minimum treatment effect for the control condition which would diminish the difference between the experiences of the two groups.

3) Some of the questions represented attitudes or opinions which the student might wish to keep anonymous; identifying pre-tests so they could be paired with post-tests would have destroyed that anonymity.

4) Both control and experimental (treatment) teachers were already providing a considerable service. Giving the test twice would have produced a greater burden for the teachers and would probably have severely limited the numbers of teachers agreeing to participate. Student motivation for repeating the same test without feedback could also have been a problem.

The PLT staff was responsible for obtaining the participation of the treatment teachers. These teachers were recruited from all teachers who had participated in the PLT training workshops. The control teachers were obtained under the direction of the BSSR and with the assistance of Mr. Rudy Shafer of the California Department of Education. Those teachers collected by the BSSR came from a cross section of Washington cummunities while the smaller California sample was primarily from the Sacramento Valley region.

The original research design called for an analysis of fifth, eighth and eleventh grade students. The fifth grades were to use the Elementary Core Lessons, while both the eighth and eleventh grade groups were to use the same secondary lessons. As the data came in, it became clear that many of the teachers who had wished to participate in the evaluation were involved with classes at grade levels other than fifth, eighth, or eleventh, or had mixes of students including some in the original target population as well as some in other grades. The number of classes at the three target grade levels (fifth, eighth and eleventh) was only a small portion of the total number of students of the cooperating teachers so the grade restrictions were dropped. The revised system combined students from fourth, fifth and sixth grades as the elementary group; seventh, eighth, and ninth as an intermediate group; and tenth, eleventh, and twelfth as the high school group.

The numbers of students in the three grade clusters for the treatment group (PLT) and the control group are presented in Table 1. At the elementary school level there are a greater proportion of fourth graders in the PLT group than in the control group. This is the result of the sampling procedure for the control condition which originally did not include the fourth grade. The few fourth graders in the control group are part of mixed grade classes including primarily fifth and sixth grade students. If the test scores were a positive function of age, this would put the PLT group at a disadvantage. In the original analysis performed on the data, the means by grade were computed. For this sample of subjects, the inclusion of the fourth grade students does not alter the overall results for the elementary grades.

At the intermediate level, the original design called for eighth grade students, so the control condition consists of a large number of eighth graders;

TABLE 1

Grade Distribution of
Treatment and Control Students

Grade	PLT	Control
Fourth	180	21
Fifth	371	347
Sixth	426	381
Total 4-6	977	749
Seventh	281	245
Eighth	188	547
Ninth	148	111
Total 7-9	617	903
Tenth	190	185
Eleventh	117	222
Twelfth	75	54
Total 10-12	382	461
Total Secondary	999	1364
Total All Grades	1976	2113

however, the number of seventh and ninth grade students with the PLT and control conditions are approximately equal so no biasing effect of age should be present. At the high school level there are again more students in the control group who are in the originally-agreed upon grade (eleventh). Again, the number of tenth and twelfth grade students is approximately equal in the PLT and the control group so no age bias should influence the results. [A more complete breakdown of the student population by grade and state is presented in Appendix C.]

INSTRUMENT

Two test instruments were developed to evaluate the effect of the PLT instructional materials; one for use with the elementary grades 4-6 and another for the secondary grades. The development of the tests went through the following process.

At the start of the test development, two major decisions were made. (1) The test should reflect the major principles presented in the PLT activities and (2) at least a portion of the test should be based on a selected set of representative lessons. Those people working on the test development decided to invent a valley called the Mega Valley which would be a generalized, prototype valley which could serve as the referent for certain test questions. The valley grew until it had one metropolis, three smaller towns, forests, parks, lakes, rivers and a proposed major ski area. A preliminary map was drawn characterizing the Mega Valley.

The principles in the appendix of the PLT Curriculum Guide were studied to suggest topic areas for questions. [A copy of the principles is included as Appendix D.] Two major types of principles were found; those which referred to cognitive outcomes and those that referred to preferred affective outcomes. For cognitive items it is usually possible to identify a correct response. The latter were more difficult to score since the choices represented a continuum of attitudes related to PLT principles.

The original question set was written with the eighth grade as the target grade. Items with a number of formats were written and organized into two preliminary forms; each form had 39 items. Parallel questions were written for elementary students. Again, two booklets were constructed, each with 31 items.

The preliminary forms were piloted on fifth, eighth and eleventh grade students in three Washington communities. The communities were chosen to reflect a small lumber-oriented community (Morton), a small city (Olympia), and a metropolitan area (Seattle).

The results for the trial run were used to determine item difficulties. The preliminary forms and the trial data were presented to the Western Regional Environmental Education Council at its July 12, 1976 meeting in Boise, Idaho. At that time, the use of the Mega Valley as a general structure was endorsed. The members of the Council individually provided feedback concerning the test items. In addition, the PLT staff extensively critiqued the items, pointing out the lack of correspondence between the material actually presented in the lessons and the test items. The primary focus of the rewrite was the elementary test with the items more closely related to the materials taught rather than the general principles.

A second preliminary form was constructed for both the primary and secondary students and was presented to the September 22, 1976 meeting of the Advisory Board. The second form for the elementary students consisted of 31 true-false items and, in addition, a set of four multiple-choice items was constructed. The secondary test consisted of 38 multiple-choice items along with the multiple-choice opinion items. After extensive critiquing, the Board approved a number of items while calling for changes and additions of other items.

After reviewing the various comments and suggestions, the final forms of the test instruments were constructed. [The elementary test used is in Appendix E and the secondary test instrument is in Appendix F.] The final rewrite of the instruments produced a balance of items directly reflecting the materials taught in the core lessons and items about the more general principles. The

items related to the core lessons were further identified as the particular lesson to which they applied. A list of the items relating to each lesson and which were directed at the principles are presented in Table 2.

The final form of the elementary test consists of 30 true-false items of which eleven are related to the Mega Valley. Four opinion items, each with four options, are at the end of the test. The secondary test consists of 38 items of which ten refer to the Mega Valley. Five opinion items are attached, each has five options. A map of the Mega Valley served as the referent for many test items and as the cover sheet for both tests.

The several revisions of the test made it difficult for the BSSR staff to obtain estimates of its reliability prior to the actual administration of the instrument. The content validity was established by a review process involving the Advisory Board, outside consultants, and PLT staff working with the BSSR.

The reliability of the final instruments was determined by the internal consistency of the tests. This procedure is not entirely appropriate as the instruments are not built to measure a unidimensional variable, but rather to tap a number of dimensions as defined by the various principles and lessons. To the extent that the principles and lessons deal with different dimensions, the internal consistency will be lower than would be true of a unidimensional variable. The internal consistency of a test is measured by the Kuder-Richardson Formula 20 (KR-20). The data for the control sample for each of the three age groups was used to compute the KR-20. These were 0.30 for the elementary sample, 0.64 for the intermediate sample, and 0.70 for the high school sample. Thus, these values appear lower than for most unidimensional variables.

TABLE 2

Items Contributing to Each of the Subscales

ELEMENTARY

Principles: Items 1, 2, 3, 4, 13, 15, 19, 21

Lesson	Items
24	7, 8
26	23, 24, 25, 26, 27
40	9, 11, 16, 20
44	17, 18, 28, 29, 30
65	12, 14, 22
78	5, 6, 10

SECONDARY

Principles: Items 1, 2, 3, 7, 8, 9, 10, 11, 12, 17, 19, 21, 34

Lesson	Items
2	20, 26, 27, 29, 30
3	23, 24
6	14, 15, 16, 28
14	18, 22, 25, 31, 38
28	4, 5, 6, 13, 32, 33, 35, 36, 37

TEST ADMINISTRATION

The test booklets were sent to the treatment teachers during the month of November, 1976. Those teachers testing more than one class were sent only one set of test booklets along with answer sheets for the actual number of students taking the test. The teacher administered the instrument. No time limit was used; but, in most cases, the instrument was completed in less than 30 minutes. All tests were given using a standard set of directions which were printed directly on the tests themselves.

The teachers then mailed the answer sheets back to the BSSR when completed. Originally the deadline for returning the answer sheets was December 15, 1976; however, because of a delay in getting the booklets to the teachers, this deadline was extended to January 1, 1977. Ultimately, any return received by January 11 was included in the final analysis.

In addition to the answer sheets, the teachers were asked to complete and return a questionnaire which inquired about the kind of community the school represented and a teacher notebook containing information about the acceptance and implementation of the lessons. The teacher notebook was then used by the BSSR to determine whether or not the test data from that class could be used as part of the treatment group. If the teacher indicated that he/she had not covered all of the core lessons, the data for the class would have been excluded. All teachers who returned the notebooks and sent in data, however, reported covering all of the core lessons and were therefore included in the treatment group.

There were two questions on the previously-mentioned teacher questionnaire which dealt with the extent to which the community was dependent on lumber-

related industries and the size of the community. We asked the teacher to provide this information. As the returns were analyzed, it became clear that without definite criteria there was considerable confusion and lack of reliability (teachers from the same community often chose different categories) in the returns. Due to this problem and the lack of response from certain classifications, it was decided that analysis on these dimensions would be meaningless. [The initial description of the community provided by the teachers is shown in Appendix G (treatment group) and Appendix H (control group).]

RESULTS

The students' responses were key punched and scored. Each participating teacher received the distribution of scores for their students (names were not used), the mean score for their class, the proportion correct on each of the items, and the distribution of students for each number of correct responses.

In addition to an overall score for each student, several subscales were scored. These included a subscale on items related to basic principles, but not material covered in the lessons; a subscale on lessons which contained all items written to measure any one of the lessons covered; and a separate subscale for the items related to each of the lessons individually. The opinion items at the end of the test booklet were analyzed as individual items. For both elementary and secondary students, this resulted in 13 separate sets of scores. The items contributing to each of the subscales was reported in Table 2 on page 10 of this report. The results of the comparison of the PLT students to the control students are reported in Tables 3-A (page 14), 3-B (page 17), and 3-C (page 20).

Elementary

There is no statistically-significant difference between the PLT students and the control students on the overall total score. The mean of the two groups is 18.8. This means that for the 30-item test, the average item difficulty is 63% (18.8/30). [One of the primary considerations in constructing the test was that it be sufficiently difficult so there would be no ceiling effect. This appears to have been achieved.]

TABLE 3-A

Means, Standard Deviations, and Results of t-Tests for Difference between PLT and Control on Total Score, Subscale Scores, and Opinion Items (Elementary Grades 4-5-6)

Item	PLT (n = 977)		Control (n = 749)		Test of Significance*
	Mean	Standard Deviation	Mean	Standard Deviation	
Total Score	18.87	2.96	18.73	2.88	t = 0.95
Principle Subscale	4.82	1.31	4.94	1.29	t =-1.98**
Lesson Item Total	14.05	2.37	13.79	2.32	t = 2.28**
Lesson 24--Origin of Urban Open Space	0.89	0.66	1.06	0.67	t =-5.11**
Lesson 26--Classroom Conservation	3.85	0.96	3.64	1.01	t = 4.22**
Lesson 40--Forest Consequences	2.48	0.96	2.26	0.98	t = 4.59**
Lesson 44--Why Wooden Pencils?	3.68	0.92	3.73	0.93	t =-1.01
Lesson 65--The Web of Life	1.97	0.83	1.92	0.81	t = 1.13
Lesson 78--Did You Notice?	1.18	0.79	1.17	0.81	t = 0.18
Opinion Item 31--Wood Production vs. Recreation	2.58	0.84	2.68	0.81	t =-2.03**
Opinion Item 32--Access for Hiking	2.62	0.83	2.76	0.86	t =-3.36**
Opinion Item 33--Individual Influence on Decisions	3.07	0.93	3.04	0.95	t = 0.70
Opinion Item 34--Supply for Needs	2.82	0.86	2.87	0.81	t =-1.11

*A negative sign indicates that the control group mean was higher.

**Denotes significance at $\alpha = .05$

When the total score is divided into those relating to principles and those relating to lessons, the results are in favor of the control group for the principles test and for the PLT group for the lessons test. The difference in favor of the PLT group on the core lessons test could be expected. The finding for the control condition on the principles test is of concern. The principles test is made up of eight items. The difference between the two groups is 0.12. While this difference is significant at the five percent (5%) level, it does not seem to represent a strong contradiction to the program.

The first of the separate lesson tests of significance again favors the control condition. This is a two-item test on "Origin of Urban Open Space." Both items are keyed "false" in the test booklet. They ask about the relative size of open space for recreation compared to the space for commercial development (item 7) and whether the space devoted to parks within the towns of Mega Valley would account for 25% of the land.

The difference between the groups on the items concerning Lesson 26 (Classroom Conservation) and Lesson 40 (Forest Consequences) are both significant with the greater mean attained by the PLT group. These lessons have five and four items respectively.

There were no significant differences on the subscales to measure Lesson 44 (Why Wooden Pencils?), Lesson 65 (The Web of Life), or Lesson 78 (Did You Notice?).

Opinion Item 31 deals with the possible conflict between recreation and wood production. Low scores view wood production as the most important function of the forests, while high scores view recreation as the most important function. The scores range from 1 to 4. Both groups have means between 2 and 3 which represents a balanced position on the importance of

these two uses. The difference between the groups is significant, however, with the attitude of the PLT group being slightly more favorable toward wood production than the control group.

Opinion Item 32 deals with the access of forest lands to hiking and camping. A score of 1 indicates endorsement of an item which would close most forest lands to hikers and campers. A score of 4 represents endorsement of an item which would have all forests open to hiking and camping. The means of both groups are again between 2 and 3. The difference is again significant with the PLT group slightly more restrictive than the control group.

Opinion Item 33 deals with peoples' ability to influence decisions about the forests. A score of 1 indicates endorsement of an item which attributes no control over the decisions to the people. A score of 4 indicates belief in the possibility of having considerable impact on decisions. The groups did not differ in their opinion. Both had mean scores above 3 indicating considerable belief in the ability of individuals to influence decisions.

Opinion Item 34 deals with the supply of forest resources. A score of 1 indicates a belief in an unlimited supply, while a score of 4 indicates a belief that we do not have sufficient supply to meet our needs. The means did not differ from PLT to control condition. Both means were 2.8 indicating some concern over the supply of forest resources. [The elementary grade results on each individual item in the test are included in Appendix I.]

Intermediate

The results for the intermediate grades 7-8-9 are reported in Table 3-B. There are significant differences between the PLT and the control condition on the total and on the two major subtests. In each case the difference is in

TABLE 3-B

Means, Standard Deviations, and Results of t-Tests for Difference between PLT and Control on Total Score, Subscale Scores, and Opinion Items

(Intermediate Grades 7-8-9)

Item	PLT (n = 617)		Control (n = 903)		Test of Significance
	Mean	Standard Deviation	Mean	Standard Deviation	
Total Score	18.00	4.35	16.57	4.61	t = 5.98**
Principle Subscale	7.38	2.11	7.15	2.16	t = 2.08**
Lesson Item Total	10.62	3.10	9.42	3.16	t = 7.16**
Lesson 2--A Look at Lifestyles	2.10	1.17	1.90	1.14	t = 3.36**
Lesson 3--...and a Side Order of Paper	1.10	0.74	0.75	0.72	t = 8.96**
Lesson 6--Community Land Use	1.68	1.09	1.53	1.03	t = 2.67**
Lesson 14--Forest Products All Around Us	2.17	1.12	1.87	1.09	t = 5.17**
Lesson 28--Why Do Trees Grow There?	3.55	1.44	3.36	1.43	t = 2.56**
Opinion Item 39--Gov't. vs. Private Forest Ownership	2.84	1.46	2.73	1.39	t = 1.45
Opinion Item 40--Wood Production vs. Recreation	2.81	1.08	2.87	1.11	t =-1.01
Opinion Item 41--Access for Hiking	2.73	1.47	2.71	1.45	t = 0.31
Opinion Item 42--Individual Influence on Decisions	3.35	1.19	3.13	1.17	t = 3.55**
Opinion Item 43--Supply for Needs	3.29	1.13	3.23	1.19	t = 1.02

*A negative sign indicates that the control group mean was higher.

**Denotes significance at $\alpha = .05$

favor of the PLT group. Of particular interest is the significance on the principles' subtest. While this difference is the weaker of the two tests on the major subtests, it is also the most encouraging since it represents an ability to generalize to non-taught materials on the part of the PLT group.

The large difference found in the lessons subtest is also reflected in the subtests measuring each of the specific lessons. Lesson 2 (A Look at Life Styles) has means of 2.1 and 1.9 for the PLT and control groups respectively. The five items on this subscale represent a wide variety of situations to which the student must generalize. The students in the PLT group were able to achieve this generalization significantly more than the control. Lesson 3 (... and a Side Order of Paper) is measured by only two items. One is closely related to the lesson while the other requires the student to generalize to another setting. Both items showed marked differences between the PLT group and the control. Lesson 6 (Community Land Use) has the smallest difference between the means of any of the lesson subscales. It is significant because students within each group had little variability in these scores. Lesson 14 (Forest Products all Around Us) is measured by five items. The difference observed is second in size to that observed in Lesson 3. The last lesson subscale, Lesson 28 (Why do Trees Grow There?) has a mean difference similar to those found on the other lessons.

The opinion items had five options representing a continuum from one extreme to an opposite position on some dimension. The intermediate options represented positions between these extremes. Opinion Item 39 concerned whether the federal government should manage the forests (score of 1) or whether the government ought to get out of forest management (score of 5). There was no difference between the means with the scores generally being in the middle of the range. The standard deviations are large indicating some polarity on this issue.

Opinion Item 40 deals with the possible conflict between the use of forests for wood production or for recreation. There was no statistically-significant difference between the groups with the means very slightly on the side of wood production as more important. The standard deviation is fairly small indicating that most people have moderate positions on this issue.

Opinion Item 41 deals with opinions on the availability of forest lands for camping and hiking. No statistically-significant differences exist between the PLT and control group.

Opinion Item 42 deals with the influence individuals can have on decisions concerning the forests. A score of 1 indicates a belief that individuals have no control over decisions while a score of 5 indicates a belief that citizen input is one of the most important parts of decisions. The means indicate that the students feel that people can have some influence over decisions. There was a significant difference between the groups with the PLT group having the stronger belief in the role of private citizens.

Opinion Item 43 deals with the supply of forest products. A score of 1 indicates a belief in unlimited supplies while a score of 5 indicates a belief that our forest products are almost exhausted. There is no difference between the groups.

High School

The results for the 10-11-12 grade classes is presented in Table 3-C. The tests of significance for the total test, the two primary subscales and the subscales for specific lessons all have non-significant differences. Likewise, three of the five opinion items do not differ significantly between the PLT and the control groups. The two items in which significant differences were observed

TABLE 3-C

Means, Standard Deviations, and Results of t-Tests for Difference between PLT and Control on Total Score, Subscale Scores, and Opinion Items

(High School Grades 10-11-12)

Item	PLT (n = 382)		Control (n = 461)		Test of Significance*
	Mean	Standard Deviation	Mean	Standard Deviation	
Total Score	20.21	4.69	20.27	5.03	t =-0.16
Principle Subscale	8.51	1.97	8.51	2.16	t = 0
Lesson Item Total	11.70	3.35	11.75	3.57	t =-0.22
Lesson 2--A Look at Lifestyles	2.42	1.12	2.50	1.17	t =-0.99
Lesson 3--...and a Side Order of Paper	1.12	0.72	1.09	0.73	t = 0.58
Lesson 6--Community Land Use	2.13	1.09	2.09	1.13	t = 0.58
Lesson 14--Forest Products All Around Us	2.41	1.22	2.29	1.14	t = 1.47
Lesson 28--Why Do Trees Grow There?	3.61	1.49	3.78	1.52	t = 1.61
Opinion Item 39--Gov't. vs. Private Forest Ownership	2.74	1.44	2.46	1.34	t = 2.89**
Opinion Item 40--Wood Production vs. Recreation	2.88	0.87	2.89	0.92	t = 0
Opinion Item 41--Access for Hiking	2.84	1.48	2.70	1.42	t = 1.44
Opinion Item 42--Individual Influence on Decisions	3.33	1.19	3.26	1.17	t = 0.83
Opinion Item 43--Supply for Needs	3.20	1.07	3.38	0.90	t =-2.55**

*A negative sign indicates that the control group mean was higher.

**Denotes significance at $\alpha = .05$

were: Opinion Item 39 concerning governmental management of forest lands, and Opinion Item 43 regarding supply of forest resources. On Item 39 the mean score for the PLT group is higher than the mean for the control group. On this item, high scores are associated with less control by the government. The difference on Item 43 has the control group with a higher mean. On this scale, a higher score is associated with a more pessimistic view of our ability to provide sufficient forest products for our needs. [The secondary grade results on each individual test item are included in Appendix J.]

CONCLUSIONS

The results indicated that the PLT materials had the greatest impact on the intermediate students. The group which had been exposed to the PLT materials did significantly better than the control condition on the total test score as well as all of the subscale scores. This impact was strongest on the portions of the test which represented learning of the material covered in the lessons but was present for the generalized questions about the principles upon which the PLT lessons were built.

At the elementary level the PLT materials had their main impact on the acquisition of the material taught in the lessons. The overall lessons subtest for the group which had received the PLT core lessons was significantly higher than for the control group. The principles subtest showed a weak reversal of effects with the control group obtaining significantly higher scores than the PLT group. On the specific lesson subtests, one came out with the control group scoring higher while two others showed differences in favor of the PLT group. The smallest effect was found in the high school group. For this age grouping there were no significant differences on the total score or on the major subtests.

Comparing the results from the intermediate and high school groups presents an expected difference on the total score and all subscales. The mean score for the older group is consistently higher than the scores for the intermediate group. The opinion items are not as clear cut as the effect of age with many of the means being approximately equal.

The opinion items for all three age groups showed some effect of the PLT materials. For the elementary group the treatment and control groups had significantly-different mean opinions on two of the four opinion items. For the

students in the intermediate age group the differences in opinion occurred on one of the items. The high school group had two opinion items on which the two groups differed. In a close inspection of the content of the opinion items on which the differences were found, means for the group exposed to the PLT materials were consistently in the direction supported by those materials; e.g., viewing citizen input as important in decision making.

A number of limitations of the evaluation should be noted:

1) The impact measured by the evaluation was that which occurred in a very short time span. The teachers often had less than a month to cover the core lessons and give the test. This may well have rushed the treatment to the point where it became less powerful than it might otherwise have been. Further work with a greater amount of time for the materials to affect the students should be conducted.

2) The teachers all used the same core lessons. This limits the actual information obtained to the impact of these specific lessons. Since these lessons were selected from a larger set, it is only assumed that similar findings would be obtained from other possible sets of lessons. This limitation was necessary in light of the time constraints to provide a common background for the test but should be lifted in further evaluations of the materials.

3) Because of the particular logistics of the evaluation, many of the teachers who were participating in the PLT group could not be identified until immediately before the evaluation. This impeded the evaluators' attempts to construct a control group which was as similar as possible to the treatment group. This resulted in a few possibly important differences between the composition of the treatment and control groups. Further work should be conducted with better control over the composition of both the treatment and control groups.

4) The testing instruments were developed with the continued review of the PLT Advisory Board. This provided primarily positive consequences as the test better reflected the concerns of the Advisory Board but it also had two drawbacks:

   a) It resulted in two substantial revisions of the instrument after two of the Advisory Board meetings. The meetings were far enough apart and the revisions sufficiently substantial that it proved impossible to pre-test the final instrument to the degree desired.

b) The Advisory Board strongly recommended changes which were well grounded from the perspective of the content specialists but which possibly weakened the test as a tool to discriminate between the treatment and control group.

Should further instruments be built for the evaluation of these materials, the review of the Advisory Board would again be sought but at an earlier date and with stronger resistance to the elimination of potentially useful items.

In sum, the student impact of the PLT materials are fairly substantial, especially at the intermediate grade levels. The major effect seems to be the transmission of specific information, but ancillary changes in both the understanding of basic principles and opinions seems to be possible. A number of puzzling results are found such as reversals of two effects at the elementary school years which deserve further inquiry. The results are particularly positive in light of the number of possible interfering factors mentioned above which developed in the evaluation.

It is the opinion of the evaluators that most of the restraints listed above made the evaluation a conservative estimate of the impact. Given (a) longer exposure, (b) more student involvement with the entire range of materials, (c) a control group not limited almost entirely to Washington students (slightly above the national average in basic skills), and (d) a variety of test instruments with greater discrimination, the impact of these materials could very well have been even more evident.

APPENDICES

APPENDIX A

Six Lessons Selected for the Elementary Grades

LESSON NO. 24

SUBJECTS Mathematics and Social Studies

GRADES 5-6

PLT PRINCIPLES 1, 2 & 4

CONCEPTS 1.1, 2.1243 & 4.31

SKILL I

LESSON OBJECTIVE Students will calculate the land area designated as parks and open space in their community and be able to state the origins of these designations.

ACTIVITY ORIGIN OF URBAN OPEN SPACE

You will need a large map of your community which shows clearly its official boundaries or city limits and its parklands.

Assign students to use the map to calculate the total land area within your community's boundaries. This will require measuring its dimensions and using the map's scale to convert the figures to square miles or acres (1 square mile = 640 acres). Students should follow the same procedure to calculate the amount of community land set aside in established parks or open space for public use. From this, they should determine the percentage of the community area devoted to parks and open space.

Have your students write or visit the appropriate city or county offices to find out the historic and political reasons these park and open space lands were allocated for public use. Was a percentage of the total community land set aside? Did public pressure play a part? Was zoning involved? Were the lands donated by private interests? Were they saved by chance?

RESOURCES

Consult the classified (yellow pages) section of the telephone book under city or county government to find the local planner's office, parks and recreation department, and department of public works.

LESSON NO. 26

SUBJECT Social Studies and Fine Arts

GRADES K-6

PLT PRINCIPLES 7, 5 & 2

CONCEPTS 7.31, 5.12 & 2.112

SKILLS V & VI

LESSON OBJECTIVE Students will be able to suggest ways that paper and other natural resources can be re-used and recycled in the classroom.

ACTIVITY CLASSROOM CONSERVATION

For one week, ask your students to save all waste paper generated by class activities. Assign groups to separate the papers into two stacks each day: One for paper that has been completely used and the other for paper that could be used again for some purpose.

At the end of the week, compare the amount of paper in the stacks and lead a class discussion on "Are we wasting paper?" Give each group some of the re-usable paper, pencils and one of these articles: Grocery bag, shoe box, magazine, gift-wrap paper, Christmas cards, newspaper, lunch sack, milk carton.

Ask each group to list on the paper all the ways they can think of to re-use the item. After 10 minutes, share the ideas. Repeat this exercise with ditto paper and other items used in the classroom such as pencils and crayons. Act on the suggestions during subsequent class activities.

VARIATIONS

1. Maintain a room recycling center (at Christmas time you might call it Santa's Recycling Workshop). Make gifts, models, table decorations, collages, bookmarks, name tags and anything else students can suggest out of recycled products from school and from home.

2. Give each student a 12 inch by 12 inch piece of masonite painted with slate to use instead of paper for practicing writing and drawing skills

3. Instead of using construction paper to teach color awareness, use colors cut from magazine pictures.

RESOURCES

Reference Books - 6, 8, 24, 44, 55
Films - 211, 212
Pamphlets - 256, 257, 267
Related Curriculum Materials - 305, 311, 313a, 313b, 313d, 313f, 315, 317, 318
Simulations/Games - 326, 330, 331, 332, 334

LESSON NO. 40

SUBJECTS Social Studies and Science

GRADES 4-6

PLT PRINCIPLES 7, 6 & 5

CONCEPTS 7.123, 6.31, 5.5 & 5.4

SKILLS IV & VI

LESSON OBJECTIVE Students will demonstrate knowledge of cultural uses of a forested area by creating and explaining cards used in a simulation game.

ACTIVITY FOREST CONSEQUENCES

Provide a large piece of butcher paper and help students create on it a mural representing a virgin forest. The mural should be contoured to show locations of mountains and valleys.

Second, lead the class in a brainstorming session to list things which might be introduced into the forest environment. Then, the students should make a deck of cards, one card representing each item on the list. Suggestions for the list are a lumber mill, roads, small community, sewage plant, telephone and electrical lines, a dam, a reservoir, a ski area, a wilderness area, a fire, a campground, a tunnel, and fences.

When the cards have all been made, place the deck face down. Each student, in turn, is to pick a card and choose a place on the mural where the item pictured on the card will be placed. The player should explain to the class why he or she selected that location and then draw a picture on the mural similar to the one on the card. If you prefer to save the mural for other uses later, the player may simply pin the game card in place, instead of copying the picture.

After all the students have had a turn, the mural is complete. Then, each student should make a consequence card which pictures the result of introducing into the forest the element shown on the first card selected by that player. Suggested consequences are a dangerous mud slide, forest fire, silting, soil erosion, noise pollution, deer population explosion, dead fish, and injured animals. The player then adds that card to the mural.

The class should make a third set of cards depicting solutions to problems shown by the consequences cards. If there are no known solutions to some problems, discuss the ramifications of not introducing the disruptive element into the forest.

RESOURCES

Articles - Cooper, C. F. "The Ecology of Fire" Scientific American (April 1961) pp. 150-160.
Connaughton, Charles "Forest Fires Damage More Than Trees" American Forest (August 1972) Vol. 78 No. 8, p. 30.
Dawson, George and Ogden Lazenby "Effects of Fire on the Environment" American Biology Teacher (May 1972) Vol. 24 No. 5, p. 269.
Hope, Jack "The Invasion of the Awful ORV's" Audubon (January 1972) pp. 37-43.
Line, Les and J. D. Perry "Snowmobiles: Love 'em or Hate 'em" National Wildlife (Dec-Jan 1972) Vol. 10 No. 1, p. 21.
Reference Books - 4, 8 (esp. Chapter 4), 14, 17, 20, 21, 26, 34, 35, 43, 45, 47, 50, 52, 56
Student's Pleasure Reading & Reference Books - 98, 118, 130, 131, 134, 135, 137, 145, 146, 152, 160, 173, 177, 178, 182
Films - 194, 195, 212, 214, 220, 223
Multi-Media - 241c, 242, 251
Related Curriculum Materials - 302, 317
Simulations/Games - 328, 329

LESSON NO. 44

SUBJECTS Social Studies, Science, and Language Arts & Humanities

GRADES 4-6

PLT PRINCIPLES 5 & 7

CONCEPTS 5.25 & 7.32

SKILLS I, II & IV

LESSON OBJECTIVE Students will be able to describe the suitability of certain materials for the manufacture of a particular consumer product.

ACTIVITY WHY WOODEN PENCILS?

Distribute papers with these headings to your students: Wood, plastic, steel, aluminum, copper, iron.

Divide your class into groups. Have a contest to see which group can come up with the longest list of products used in the school which are made from each of the materials named. You may wish to award tree seeds or seedlings as prizes to the winning group. (Contact a local forest industry nursery or your state's department of natural resources for seedlings.)

When the lists are complete and the winning group determined, ask each student to pick any three products, each made of a different material (for instance, a pencil, a metal locker and a plastic table) and write a brief explanation of why that product was made from one material rather than another. In other words, why are most pencils made of wood rather than steel or plastic? What properties do these materials have which lend themselves to particular uses and not to others? Which are renewable? Reusable? Recyclable?

RESOURCES

Reference Books - 8 (esp. Chapter 1), 26, 34, 35, 45
Student's Pleasure Reading & Reference Books - 149, 184, 187, 188
Pamphlets - 255, 272, 276, 283, 290, 291
Related Curriculum Materials - 319

LESSON NO.	65
SUBJECTS	Science and Fine Arts
GRADES	4-6

PLT PRINCIPLES	6 & 5
CONCEPTS	6.3, 6.11, 6.42, 6.22, 5.1 & 6.23
SKILLS	I & II
LESSON OBJECTIVE	Students will be able to describe the interdependence of various forest organisms with other components of the forest.
ACTIVITY	THE WEB OF LIFE

Materials:

Enough large sheets of cardboard box materials to construct a mural 4 feet by 8 feet.

Procedure:

Ask each student to select his or her favorite, or a particularly interesting forest animal (mammal, insect, bird, or reptile). (If duplicates occur, differentiate by labeling them young, old, male, and female.) The student is to collect as much information about the organism as possible and should attempt to answer some of these questions:

1. Where does the animal live? Why does it live there?
2. What must it have available in order to live successfully? (In other words, what are its habitat requirements?)
3. What does it prey upon (eat)? How much does it eat?
4. What shelter (cover) does it require?
5. Where does it perch, hibernate, breed, sleep?

6. Does it live on the ground, in trees, at the edge of the forest, in the forest?

7. Where does it get its water?

8. Does it migrate? If so, when and where?

9. What animals prey (eat) on it?

10. What animals does it live with? What plants?

11. How does the animal influence its environment?

Tell your students to try to find photographs or drawings of each animal. Those showing the animal in its natural habitat are especially desirable. Photographs taken by the students would be excellent.

Now students should create a mural of a forest ecosystem on the cardboard sheets. They may use pictures cut from magazines or their own drawings to show hills, valleys, streams, and other topographical features. They should cut paper silhouettes to resemble trees and other forest plants and add them to indicate forests and meadows.

When the mural is finished, students should glue or pin on pictures or drawings of the animals they have studied. The animals should go in appropriate habitats and each student should tell the class his or her reasons for placing the animal in a particular spot. While the students are sharing the information they have gathered, talk about:

What did you discover about the animal which surprised you the most?

Why did you select the species you did? Have you ever seen it before? Would you know where and when to look for it? Did you know before you studied it?

Is it an endangered species? If so, why? Is anything being done to help or harm it?

When all animals are in place, discuss the "web of life" concept which could be described as who eats whom?

First, place a push pin in each animal. Then use yarn to connect one animal to the other animals and plants with which it interacts. Students can help by acting as wildlife experts on the species they have researched.

They are to make sure their animal is attached to all of the other <u>appropriate</u> components of the forest ecosystem depicted on the mural.

Each animal should be connected using a different color or size of yarn or heavy thread. Upon completion, you will have a complete "web of life" for this forest ecosystem.

As a follow-up, seat students on the floor and have each choose an animal or plant depicted on the mural he or she would like to be. (Again, if duplicates occur, have them be young or old, male or female, or select another role.) Have students make a name tag labeling the role they are playing. Then, starting with one "plant," have that student hold on to the end of a spool of string. Using the mural as a guide, connect a second student to the first. The second student wraps the string around his hand and passes it along to a third. This process is continued until each "organism" is linked to the ecosystem and the spool is given back to the first student.

Now, have students move back and out until all of the slack is taken up and then jiggle the string to feel the system's "vibrations."

Ask students to decide which link in the system is the least important and have that link drop out. Take up the slack again.

Continue to remove links which the students feel are unnecessary to the system or which cannot survive when other links are removed.

As the links are removed, discuss:

1. What happens when we remove a link in the ecosystem?

2. Can the system withstand the loss of these links forever? Why or why not?

3. What will eventually happen to a system which becomes less and less complex? Why?

4. Were the changes more dramatic when the system was composed of many parts (links) or when it had fewer parts?

5. What generalization might we make about the relationship between a system's complexity (diversity) and its stability?

6. Can you think of any systems which people have or are creating which might be considered ecologically unstable because of their lack of diversity? What might be done to reduce the hazards of such systems?

RESOURCES

Articles - Lutz, H. J. "Forest Ecosystems: Their Maintenance, Amelioration, and Deterioration" Journal of Forestry (1963) 61:563-569.
Natural History "The Metro Forest" Natural History (November 1973) Special Supplement pp. 45-83.
Uetz, George and Donald L. Johnson "Breaking the Web" Environment (December 1974) Vol. 16 No. 10, pp. 31-39.

Reference Books - 14, 15, 17, 26, 34, 35, 42, 43, 45, 47, 50, 52

Student's Pleasure Reading & Reference Books - 62, 65, 75, 77, 83, 89, 92, 97, 100, 101, 112, 121, 122, 123, 126, 127, 128, 130, 131, 134, 140, 141, 151, 161, 178

Multi-Media - 241a, 241b, 241c, 247, 251

Pamphlets - 261e, 264, 266, 269, 270, 289, 293

Related Curriculum Materials - 310, 315, 317

LESSON NO.	78
SUBJECTS	Science, Social Studies, and Fine Arts
GRADES	4-6

PLT PRINCIPLES 3, 6 & 7

CONCEPTS 7.123, 6.23, 6.31 & 3.4111

SKILLS I, IV & VI

LESSON OBJECTIVE Students will choose an environment and be able to describe changes they observe in it.

ACTIVITY DID YOU NOTICE?

Assign each of your students to take a walk through a forest, urban district, vacant lot, park, or the area around and including the student's home.

The students should walk and observe for at least 30 minutes. Stress with them that all their observations are relevant and should be recorded either in writing or on tape.

These observations may include:

Impressions of the area; why did the student choose this area and does he or she like it?

What was the area like originally? Trace its history.

What vegetation is there and what used to be there?

If this is an urban area, what vegetation was there before there were buildings on it?

What wildlife would you guess once lived there?

How has the environment been altered? Why? By whom?

Do you think the changes were beneficial or detrimental? Why?

What type of environment would you expect to have found if the area had remained undeveloped? Why?

Ask students to bring their observation reports to class to share. Discuss humankind's role in changing the environments the students visited.

1. Were most changes for the better or for worse?

2. What determines which are beneficial and which detrimental?

3. How might time and circumstances influence our opinion on whether a change is good or bad?

VARIATION

Divide your class into small groups for the purpose of making a mural to show how local vegetation has changed since humans first settled in your area. Assign a specific historical time period to each group, beginning with early Indian times.

If you have younger students, you may wish to shorten the time span to cover only the period since their grandparents were born.

Students can gather the necessary information about the environment by interviewing longtime residents of the community, asking for help from the city library and consulting the local historical society and/or museum. Questions to ask should be developed first in class.

Students then should use the information to produce their section of the mural, showing the vegetation as it was during their assigned time period. When the mural is finished, discuss:

1. Has the vegetation which originally was present changed? How much?

2. What were some causes of these changes?

3. Which of these changes do you think made your community a better place in which to live? Which made it a less pleasant place to live? What determined whether the changes were good or bad?

4. Were most of the changes good, bad, or in-between?

5. Were any changes considered good at the time they occurred and bad later on? Did conditions existing at the time of change influence public opinion on whether the change was good or bad? How?

If the students' interviews with residents are recorded, they could become valuable historical records, especially if they could be cataloged by the school librarian.

RESOURCES

Reference Books - 14, 16, 30, 31, 42, 45, 56, 57, 58
Student's Pleasure Reading & Reference Books - 67, 78, 89, 108, 130, 131, 134, 136, 146, 175
Films - 192, 194, 202, 208, 211, 212, 214, 220
Multi-Media - 226, 231d, 231e, 233, 241a, 241b, 241f, 246, 248, 249
Pamphlets - 259, 265, 282
Related Curriculum Materials - 302, 304, 306, 310, 316, 317, 320, 321
Simulations/Games - 325, 328, 329

APPENDIX B

Five Lessons Selected for the Secondary Grades

LESSON NO. 2

SUBJECT Social Studies

GRADES 7-12

PLT PRINCIPLES 7 & 5

CONCEPTS 7.1221, 7.3, 5.12 & 5.121

SKILLS VI & V

LESSON OBJECTIVE Students will be able to identify ways they might change their lifestyles to reduce their consumption of natural resources.

PROBLEM The impact of current consumption patterns on the future supply of natural resources.

ACTIVITY A LOOK AT LIFESTYLES

Ask your students to list the renewable and non-renewable resources they have used or consumed in the past 24 hours and identify each as 1) essential for survival 2) necessary for maintenance of their present lifestyle or 3) a luxury.

Students then should propose alternatives for each item listed in categories two and three which they believe are inefficient or wasteful. Compile a master list of the resources used and the proposed alternatives and discuss these questions:

1. Are any items listed in the "essential" category really not essential? What is your criteria for evaluating an item's necessity?

2. Are any items listed in the second category really luxuries? On what basis do you judge an item a luxury?

3. What would be the environmental and economic impact of your alternatives? Would they increase the use of renewable resources? (For instance, switching from aluminum foil to cellophane food wrap would accomplish this.) Or, would they increase the use of nonrenewable resources? (Switching from paper cups to plastic cups would have this effect.) Would they increase the use of energy?

4. Look at the list of luxury items. Which of these could you give up without a major change in your lifestyle?

5. Make a list, beginning with the easiest to give up and ending with the most difficult. Could you give up the top three items on this list for a day? A week? A month? Do it.

RESOURCES

Articles - 32, 38, 45, 81, 82, 83, 96, 107, 131
Reference Books - 238, 252, 266, 283, 284, 330, 351, 358, 361, 362, 379, 398, 419, 431, 449, 481
Films - 633 and The Limits to Growth (Lane County I.E.D.: Eugene, Oregon)
Multi-Media - 652
Pamphlets - 681, 684, 685, 695, 702, 704, 705, 706, 708
Related Curriculum Materials - 797, 804, 813

LESSON NO. 3

SUBJECT Social Studies

GRADES 7-12

PLT PRINCIPLES 7, 5 & 2

CONCEPTS 7.31, 7.3, 7.21, 5.12, 5.121, & 2.11

SKILLS VI, IV & I

LESSON OBJECTIVE Students will be able to state how and why consumer decisions should reflect consideration of the economic and environmental trade-offs involved.

PROBLEM Resource consumption levels of the current American lifestyles.

ACTIVITY ...AND A SIDE ORDER OF PAPER

The take-out, fast-food industry has a big appetite for paper. It uses hamburger wrappers; boxes for the wrapped hamburgers; cardboard trays for the bag and the box and the wrappers; napkins; straws wrapped in paper; salt, pepper, sugar, and powdered cream in paper packets; coffee cups; soft drink cups. And all the packaging is discarded within 15 minutes after its contents are consumed, a practice that contributes to the country's solid waste problem. Energy studies show that the equivalent of 12.7 million tons of coal and a sustained yield of 315 square miles of forest was used to provide packaging materials for hamburgers sold by just one fast-food chain in 1971 (Chicago Sun Times, Monday, October 30, 1972, "Fast Foods Squandering U.S. Resources" by Bruce Ingersoll).

This study project examines the trade-offs, economic and environmental, involved in the consumption of resources through packaging.

Divide the class into small groups. Each group will survey a local fast-food restaurant to find out how much paper it uses in a given period of time, such as a week or a month. Before beginning the survey, students should make up a questionnaire to be used when they interview the restaurant manager. Suggested questions are:

1. What items made of paper does your establishment use?
2. How many of each item do you use per (insert time period)?
3. What companies supply these paper items?

4. Why do you use paper packaging? (Answers might relate to cost, convenience, health codes, etc.)

5. Do you think you are overpackaging your products? (Remember, you want to keep the restaurant manager friendly, so be careful how students phrase this question.)

6. What percentage of the total cost of your product does the packaging represent?

7. How much do your employes make per hour?

8. Where and how do you dispose of your restaurant's solid waste (e.g. landfill, incinerate, recycle, etc.)?

When students have completed their interviews and tabulated their data, explore some of the following questions:

1. What were the principal reasons given for the use of paper packaging?

2. Are any of the paper items used by the fast-food outlets produced locally? If so, how many jobs are dependent upon sales of these products? (Don't forget printing, transportation, manufacturing of machines to print, making paper, etc.)

3. If fast-food restaurants decreased or eliminated paper packaging, who would lose their jobs? Would other jobs compare in pay to the jobs lost in the paper mills?

4. What alternatives do paper mill employes, printers, cup manufacturers and other workers have if they are layed off? Could they be retrained for other jobs?

5. What alternatives to paper packaging are available to the restaurant owners? What is the environmental and economic cost of these alternatives?

6. How would the alternatives affect the cost and convenience of take-out food? What price do we pay for convenience and, in your opinion, is the convenience worth the price?

7. Would you be willing to accept more expensive food if the higher price resulted in less energy and resource consumption?

8. If our population continues to grow within a finite resource base, which type of jobs would increase faster: The service-oriented, such as television repairmen and restaurant workers, or the resource extraction and process-oriented, such as paper mill workers and printers? Why?

RESOURCES

Articles - 3, 33, 42, 77, 81, 96, 107, 146, 167, 220, 222
Reference Books - 265, 266, 297, 394
Student's Pleasure Reading and Reference Books - 520
Films - 618, 619
Multi-Media - 652, 664
Pamphlets - 676, 681, 684, 685, 686, 695, 702, 704, 705, 706, 708, 711d, 728
Related Curriculum Materials - 797, 804, 813, 812a, 812b, 812f
Simulations/Games - 841 & 849

LESSON NO. 6

SUBJECT Social Studies

GRADES 7-12

PLT PRINCIPLES 4, 6 & 7

CONCEPTS 4.41, 4.44, 4.47, 6.23, & 7.124

SKILLS I, II & IV

LESSON OBJECTIVE Students will be able to describe changes which have occurred in a specific locality as a result of humankind's activities and to distinguish between planned and unplanned and helpful or harmful changes.

PROBLEM The loss of agricultural land, including forest and associated wildlife, to nonagricultural uses on suburban fringes.

ACTIVITY COMMUNITY LAND USE

Divide the class into four groups. Each group will study your community's land use in one of four time periods: the present; 25 years ago; 50 years ago; and 100 years ago.

Group members will collect data from community records, including old maps and photographs, and make a map illustrating the land-use pattern during the period they are investigating. All four maps should be made to the same scale.

After the maps are completed, students will compare the land-use patterns and discuss the changes.

Has the community's size changed? If so, how?

Has the land-use pattern changed? What uses have increased? What uses are decreasing? Have any of the original uses disappeared?

Ask students, either individually or in small groups, to interview residents who have lived in the community for from 25 to 50 years to find out their perceptions of changes. If possible, the interviews should be recorded on tape.

From the interviews, students can determine:

1. What was the general ratio of people who believed the land-use changes were harmful as compared to those who believed they were helpful?

2. What reasons did the residents give for their opinions on the changes?

3. Do any residents who believed a change would be helpful at the time it took place now think it was detrimental to the community? Do any of them believe a change they originally thought was harmful has turned out to be beneficial?
(Note: Students should consider facts which might affect the validity of the data obtained from responses to their questions. Most people don't like to admit they were mistaken.)

The class then should discuss what land-use changes appear to be coming in the future. Do the students think these will be helpful or harmful? Ask them to state reasons and criteria to support their opinions. Can the students suggest mechanisms available to insure that most changes will be beneficial?

VARIATION

Have your students make or look at a map of their community which identifies current uses of the land (shopping areas, parks, streets, industrial sites, etc.)

Using the map, students should compile a table showing the amount of land devoted to each type of use. You may wish to divide the class into small groups and ask each group to calculate the acreage devoted to a specific use.

After the table is finished, discuss some of these questions:

1. What kind of use occupies the greatest amount of land?

2. What portion of the land is devoted to green or open space. Is it enough? How do you decide?

3. Is there a pattern to the land use or does it appear to have developed by chance?

4. Does your community have a land-use plan? If so, what are the goals of the plan and how is it put into effect? If there is no plan, are any steps being taken to develop one?

RESOURCES

Articles - 44, 59, 60, 109, 155, 183, 211, 219, 224
Reference Books - 243, 244, 256, 258, 259, 276, 279, 285, 288, 306, 319,

362, 367, 369, 377, 381, 382, 384, 391, 415, 431, 439, 467, 468
Student's Pleasure Reading and Reference Books - 544
Films - 569, 602, 610, 625, 634, 638
Multi-Media - 671
Pamphlets - 692, 693, 703, 727, 736
Related Curriculum Materials - 804
Simulations/Games - 820, 822, 823, 831, 834, 836, 837, 852

LESSON NO.	14
SUBJECTS	Social Studies, Home Economics and Industrial Arts
GRADES	7-12

PLT PRINCIPLES	1, 2, 3, 5 & 7
CONCEPTS	1.1, 2.11, 3.1, 5.12, 5.121, 7.124, 7.1221, 7.2 & 7.3
SKILLS	I, II, IV & VI
LESSON OBJECTIVE	Students will be able to list ways in which the American lifestyle depends upon forest products.
PROBLEM	The influence of consumer practices on resource-management options.
ACTIVITY	FOREST PRODUCTS ALL AROUND US

The forest industry, like every other industry based on a major natural resource, provides goods which are integral parts of our country's economy and lifestyle. In turn, the continuing supply of those integral parts depends upon the intelligent management of the forest resource.

Management options and policies ultimately are influenced by consumer demand for products and services. The activities outlined here explore our dependence on forest products in the hope that the result will be more intelligent consumer choices and practices.

ACTIVITY I

Ask students to use their time on the way to school tomorrow to look for any things which are new, such as recently constructed buildings, materials in trucks en route to stores or factories, products in store windows and the like.

In class, each student should list the new things he or she observed which use wood or wood fiber. Then the class should compile a master list. Item by item, have the class discuss:

1. What would happen if suddenly this product was unavailable?

2. Would this product's disappearance affect any of the essentials necessary for survival as, for example, food or shelter? What things are truly necessary for survival?

3. Is the product's current use wasteful? Why? Should the use be eliminated? What would be the impact if it were?

4. Could we find a substitute for this forest product? Is the substitute made from a renewable or non-renewable raw material? What would be the environmental and economic impact of the substitute?

ACTIVITY II

Allow 15 minutes for each student to list ways he or she uses paper and other forest products within a specified time period, such as a year. Students then should draw a line through items on their lists they believe are least important to them and circle three items they consider essential or most important.

Next to each of the three top priority items, the student should write down a product or material which could replace it. For example, instead of using paper to record thoughts, cassette tapes could be substituted.

Lead a class discussion on the comparative merits of the alternatives proposed:

1. What environmental and economic factors are involved?

2. Does the substitute serve the same purpose as efficiently and as cheaply?

3. Is the substitute made from a renewable or a non-renewable raw material?

4. Will the substitute require more or less energy to produce than the original forest product?

ACTIVITY III

Organize a wood-finding tour. To accomplish this, you may get permission from the store manager and make a class visit to a local department store or you may use a mail-order catalog in the classroom.

As a preliminary step, the class should make up a survey sheet for recording information. Divide the class into teams of three or four students each and ask each team to name one of its members as "recorder." The recorder will log team observations on its survey sheet.

Assign each team to a particular department in the store or a section of the catalog. Students are to identify and record as many items as they can which use wood or other forest products. Additional information such as unit cost and place of origin also may be gathered.

After data has been collected and tabulated, discuss these questions:

1. How would your lifestyle be altered if forest products suddenly became unavailable?

2. How many items listed represent basic survival needs? How do you decide which are needs and which are only wants?

3. Using existing technology, could you find substitutes for any of the items listed? What are the environmental and economic trade-offs involved?

4. What factors (lifestyles, population growth, management, increased demands of the Third World) may affect the supply and price of forest products?

ACTIVITY IV

Ask your students to brainstorm a list of forest product uses in these areas of home living:

1. Kitchen (cutting board, knife handles and ?)
2. Interior (furniture, shutters, coat hangers and ?)
3. Maintenance (broom handle, vacuum cleaner bags and ?)
4. Food (vanilla, nuts, wild game and ?)
5. Exterior (fence post, picnic table and ?)

Divide the class into small groups and ask the students to use the list for discussion to answer these questions:

1. Which of the items listed are necessary for human survival?

2. Which of the items are wasteful and which reflect sound conservation practices? What criteria do you use to make this judgment? Which of the wasteful products are you willing to eliminate or find a substitute for? What would be the environmental and economic impact on our society if everyone avoided the wasteful products?

3. Look at the items you decided were essential. Using existing technology, are there materials available

which could be substituted for the forest products used? What are the environmental and economic trade-offs involved in the substitution? Do you think the substitute material would serve as well or as efficiently as the forest product?

VARIATION

Ask your students to brainstorm a list of environmental factors affected by the forests. The list might include such things as water quality, air quality and landscape esthetics.

Each student should choose one item from the list and create a poster advertising its value to humankind, other organisms, and/or the biosphere.

Posters should be displayed and discussed for their graphic merits and for their accuracy.

RESOURCES

Articles - 32, 42, 45, 56, 81, 96, 120
Reference Books - 252, 265, 266, 283, 314, 348, 351, 381, 382, 398, 419, 449
Films - 571, 574, 575, 588, 593, 600, 607, 612, 631, 632
Multi-Media - 647, 669
Pamphlets - 680, 685, 686, 730, 739, 746, 759, 766, 769, 770, 774
Related Curriculum Material - 815

LESSON NO. 28

SUBJECTS Social Studies and Science

GRADES 7-9

PLT PRINCIPLE 6

CONCEPTS 6.43, 6.421, 6.42, 6.44 & 6.23

SKILLS I, V

LESSON OBJECTIVE Student will become aware of the differences between the major forest types in the United States and be able to state why these types are located where they are.

ACTIVITY WHY DO TREES GROW THERE?

Divide the class into six groups. Assign each group one of the six forest types present in the United States. These include the Northern; Southeastern; Central Hardwood; Rocky Mountain; Subtropical; Pacific Coast.

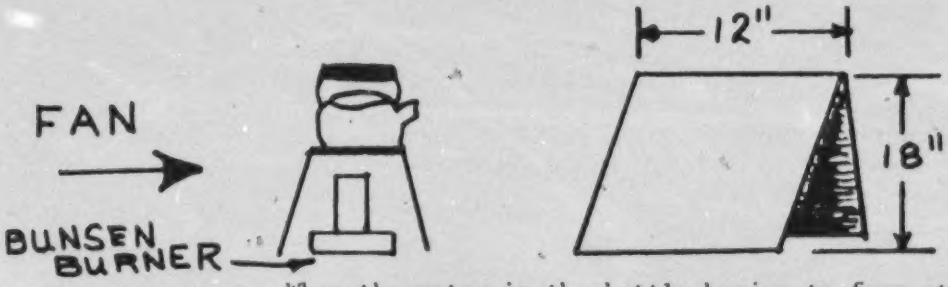
Each group is to demonstrate using maps, charts, and graphs, why its type of forest exists where it does and what distinguishes its forest region from the others. Maps and charts might illustrate geographic features; rainfall; area covered by the forest region; growing season; altitude; highest and lowest temperatures and soil types.

The groups should present their findings to the class. Their reports should attempt to answer:

1. Why is this forest type where it is?
2. Was it always within the boundaries it now has?
3. How does the soil type affect the forest type present?
4. How does rainfall affect the forest type present?
5. How have humans influenced the extent and character of this forest type?

VARIATION (Inside)

Construct a metal "tent" and place it in the refrigerator for two to three hours. (Do not remove until rest of experiment is ready.) Place a teakettle and fan to one side of the "mountain" as below.



When the water in the kettle begins to form steam, remove the sheet metal "mountain" from the refrigerator and place it downwind from fan and kettle. Direct the steam with fan so that it passes up and over the "mountain." Which side of the mountain is the driest? Which would be more favorable for plant growth? Can you think of any mountain ranges where there are deserts or near-deserts on one side and lush vegetation on the other (Cascades, Olympics, Sierra Nevadas, Rockies) ?

(Outside)

Then, using a piece of cardboard 12 inches by 16 inches, fold down the middle to create a similar "tent."

On each side of this "mountain" fasten a thermometer. Out on the schoolground: Turn the "mountain" north and south, east and west, northwest and southwest, etc. Have students record sunny side temperature and shady side temperature of each setting.

Discuss the following:

Which way do the mountains nearest you lie? Which side of the mountain is the warmest? Coolest? Are there differences in plant life on either side? Why? Is one side moister than the other? Why?

Walk around the school yard: Find a large boulder, a stump, a car, a tree, a building. Measure the temperature on sunny side and shady side of each.

Are these microclimates? What differences would you find on the shady and sunny sides of boulders and stumps? (Mosses, molds, dampness on shady side--plus the animal life that likes this; less vegetation, less growth, and different wildlife on the dry side.)

Does this demonstrate the adaptation of organisms to their environments? How?

RESOURCES

Articles - 1 & 122
Reference Books - 240, 246, 249, 280, 302, 303, 350, 352, 364, 373, 374, 409, 420, 427, 440, 444, 445
Student's Pleasure Reading and Reference Books - 493, 501, 506, 543, 547, 548, 550, 552
Films - 578, 579, 580, 582, 583, 590, 598, 600, 609, 627, 629, 631, 637
Multi-Media - 649, 653, 654, 656, 657, 660, 665
Pamphlets - 676, 677, 741, 750, 753, 765, 767
Related Curriculum Materials - 793, 803, 808, 810

APPENDIX C

Breakdown of Student Population by Grade and State

PROJECT LEARNING TREE

Numbers of Students in Treatment Group by State

STATE	GRADE LEVEL			TOTAL NUMBER OF STUDENTS
	4-5-6	7-8-9	10-12	
ARIZONA	123	159	-0-	282
CALIFORNIA	136	137	32	305
COLORADO	43	97	-0-	140
IDAHO	202	170	76	448
MONTANA	11	-0-	-0-	11
NEVADA	106	50	10	166
OREGON	152	47	-0-	199
UTAH	145	-0-	176	321
WASHINGTON	59	-0-	22	81
WYOMING	-0-	-0-	23	23
TOTALS	977	660	339	1976

Numbers of Students in Control Group by State

STATE	GRADE LEVEL			TOTAL NUMBER OF STUDENTS
	4-5-6	7-8-9	10-12	
CALIFORNIA	83	8	102	193
WASHINGTON	666	895	359	1920
TOTALS	749	903	461	2113

APPENDIX D

Principles of Project Learning Tree

CURRICULUM FRAMEWORK

This Project Learning Tree curriculum framework outlines the content, skills and attitudes for the learning activities presented in this guide. The framework is organized around seven PLT Principles highlighted in capital letters below. Instead of learning activities tied to specific disciplines or subjects, the teaching and learning of skills, content and exploratory values contained in this guide can be adopted to any traditional subject area, regardless of grade, using the below framework.

1.0 INSTILL A DEEP APPRECIATION (LOVE) FOR THE DIVERSE FOREST ENVIRONMENT
- 1.1 The maintenance of a varied and beautiful life-support system is essential to both physiological and psychological health
  - 1.11 Contrast and variety that are important to mental health are available in the forest and elsewhere
  - 1.12 A recognition of beauty and quiet in the forest environment is necessary for a feeling of well-being in many people
  - 1.13 Opportunities to experience and enjoy nature are psychologically rewarding to many and important to mental health

2.0 DEVELOP AN AWARENESS OF THE DIVERSITY AND IMPORTANCE OF FOREST RESOURCES AND THEIR CONCOMITANT VALUES AS THEY RELATE TO THE ENVIRONMENTAL, ECONOMIC AND SOCIOLOGICAL HEALTH OF THE REGION, THE COUNTRY AND THE PLANET
- 2.1 The forest has many uses and values; most of which are compatible with each other, but some of which may be temporarily or permanently incompatible
  - 2.11 Many people in their daily life rely on a significant number of forest-generated products
    - 2.111 The construction and maintenance of human dwellings is dependent upon the use of considerable quantities of natural resources, many of which are obtained from the forest
    - 2.112 The forest environment is the source of many raw materials, gene pools of potential value and energy
  - 2.12 Everyone in his daily life must rely upon the influence of the forest on the overall community -- including both its physical and cultural environment
    - 2.121 Plants, including trees, influence the composition of the atmosphere which strongly affect human and other animal's comfort, health, safety, economy and social structure
      - 2.1211 Forest plants, in carrying on food production (photosynthesis) affect the balance between supplies of carbon dioxide and oxygen in the atmosphere
      - 2.1212 Forest plants release various volatile (evaporable) compounds into the atmosphere that have an affect on other living things
      - 2.1213 Forest plants release pollen, spores and other light solid substances into the atmosphere
      - 2.1214 Plants, including trees, are very effective visual screens, windbreaks and noise barriers
    - 2.122 Plants, including trees, have effects on the terrestrial environment
      - 2.1221 Forest plants and plant litter (leaves and stems) cover the ground to varying degrees, protect the surface from wind and water, slow evaporation of water from the surface and prevent direct sunlight from reaching the ground
      - 2.1222 Forest plant roots stabilize the soil by binding it together
      - 2.1223 Forest plant roots change soil texture by mechanically breaking up particles
      - 2.1224 Forest plants add organic matter to the soil as leaf, stem and root litter
      - 2.1225 Forest plants add and remove chemical elements to soil which may change its chemical composition and structural nature
    - 2.123 Forests affect the hydrological cycle by influencing the quantity, quality, composition and distribution of water in the cycle
      - 2.1231 Forest plants intercept falling rain and snow which decreases the amount reaching the soil and reduces the erosive effect of the precipitation simultaneously decreasing runoff and/or storage and increasing evaporation
      - 2.1232 Forest plant roots, stems and litter mechanically slow water runoff from the land's surface and increase infiltration of the water into the soil
      - 2.1233 Forest plants increase atmospheric water (humidity) by giving off water through the process of transportation
      - 2.1234 Forest plants use water from the soil-for-life processes thus reducing the supply stored in the ground
    - 2.124 The forest provides intrinsic aesthetic benefits (values) that are assuming increasingly greater significance to individuals and society
      - 2.1241 The forest environment offers the opportunity for a wide variety of leisure time activities

2.1242 Many forms of leisure-time activities are dependent upon the forest environment although they themselves do not physically take place within that environment
2.1243 Forest plants used in landscaping lend a natural beauty to our communities
2.1244 Forest plant communities provide natural beauty and spiritual uplift to many people

2.13 Many communities are highly dependent upon local forest, forest industries and forest recreation for economic and cultural stability

3.0 DEVELOP AN UNDERSTANDING OF THE IMPACT OF AND ROLE PLAYED BY THE FOREST ENVIRONMENT IN SHAPING THE POLITICAL, ECONOMIC AND SOCIOLOGICAL EVENTS AND BEHAVIORS OF THE PAST, PRESENT AND FUTURE

3.1 Natural resources form the basis for every economy

3.2 Availability and use of natural resources are affected by the social and economic needs of a culture and directly or indirectly by philosophy, religion, government and the arts

3.21 The economic level (standard of living) of a region depends upon the utilization of its human, cultural and natural resources and technology over time

3.211 Goods and services are produced by the interaction of labor, capital, technology and natural resources

3.22 The distribution or location of resources in relation to population, technological and economic factors are critical to problems of resource conservation and use

3.221 Natural resource, water and minerals, in particular are unequally distributed with respect to land areas and political boundaries

3.222 No country is entirely self-sufficient in its natural resources, therefore resources should be understood within the context of a world view of humankind's needs

3.223 The political and economic strength of a country is often heavily dependent upon its access to domestic and foreign resources and international trade

3.224 Foreign policy, international trade and relations are greatly influenced by the availability of and access to natural resources

3.3 The history of a people evolves through the interaction of individuals, groups, cultures and events with the environment

3.31 Most cultures had forest related-origins

3.32 An important factor in the history of many civilizations (including their demise) has been their use or misuse of the forest

3.33 A major portion of the history of the U. S. was fundamentally influenced by its citizens' interactions with the forest environment

3.4 The relationship between man and the biosphere is modified by his culture

3.41 The forest environment has psychological impact on people

3.411 The need for man to turn inward for self-renewal can be stimulated by his external aesthetic experiences

3.4111 The forest has frequently provided a model for creative expression in music, art and literature

3.412 Part of the meaning of a culture can be understood by exploring its concept of and values related to the forest community

3.4121 Artisans record those aspects of the environment which to them have meaning thus the creative works of a people is an indication of their perception of and response to their environment

3.4122 Literature provides a unique and significant kind of knowledge about man's relationship to his environment

3.42 The ability of the individual to perceive increases his awareness and contributes to the development of an environmental perspective

3.421 A person's perception of his environment is largely conditioned by the culture in which he is raised. The language he speaks and the literature embodied in that culture contribute significantly to that perception

3.422 Man has developed many belief systems to help him explain environmental mysteries and these often shape the nature of his interactions with his environment

4.0 ACQUAINT STUDENTS WITH THE PERSPECTIVES FROM AND BY WHICH VARIOUS INTEREST GROUPS JUDGE CONTEMPORARY FOREST/ENVIRONMENTAL ISSUES: THE MECHANISMS BY WHICH THESE ISSUES ARE RESOLVED AND WAYS IN WHICH THEIR OUTCOME MAY BE INFLUENCED

4.1 Individuals perceive different self-roles depending upon their position in the social, economic and environmental contexts

4.11 The nature of the free enterprise system is such that short-term economic realities should be balanced by long-range resource planning

4.12 People vary widely in their perception of the forest environment; consequently language used to influence them must be based on knowledge of their values and interest

4.13 Words and phrases relative to forest/environmental issues carry connotative and emotional impact as well as denotative value and must be used and understood in light of this fact

4.14 Ideas vary widely in their degree of full representation of reality and must be evaluated in light of this fact

4.2 Citizenship assumes as informed an understanding as possible of the decision-making process; this necessitates knowledge of the values that enter into a decision, the persons and institutions which are influential, and how the decision may affect long term policy

4.21 The responsibility for forest conservation should be shared by everyone
4.22 Effective citizens need to be informed about pressures and a variety of institution structures (agencies, interest groups, money, etc.) which influence the planning and management of the forest resource
4.221 Forest conservation policies are often the result of group action and interest groups (public and private) and are vital to the democratic system
4.222 Understanding of and participation in the various levels of government (local, regional, state and national) can ensure the development of a society in which all citizens live fruitfully
4.2221 Citizenship includes the opportunity to participate freely in helping to make and change public policy, if a citizen wishes to do so
4.2222 Participation is not restricted to voting but may also take the form of joining with others in groups to influence policy by lawful means and communicating in other ways with elected or appointed persons in government
4.3 Management of natural resources requires the flexibility to respond to changing human needs, technological advances, new scientific knowledge, governmental policies and unusual conditions
4.31 Conservation policies come about as a result of interacting social process; science and technology, government operations, private and public interest and attitudes through consideration of aesthetic, ethical and economic factors
4.311 All forms of artistic expression based on the natural world can be positively persuasive influences in developing a congenial environment
4.32 Conservation policies and laws in a democracy are means by which the majority tries to ensure that a few do not impair the resources for all
4.33 The management of natural resources to meet the needs of successive generations demands long range planning, since the options available to future generations must not be foreclosed
4.4 Forest land is used in different ways depending upon its bio-physical characteristics, the needs and desires of society and the preferences of its present owners
4.41 Man has the responsibility to develop an appreciation of and respect for the rights and preferences of others
4.42 In a democracy, basic theory is that increasing restrictions on resource allocation and use are imposed by the consent and/or insistence of the people
4.43 As populations increase and/or as resource supplies decrease, the freedom of the individual to use the resource as he wishes decreases irrespective of the form of government
4.44 We have legal ownership of some resources like real estate and control others during our lifetime -- but ethically we are <u>stewards</u> rather than <u>owners</u> of the resource base
4.45 The collective society is the owner of the <u>public</u> lands, therefore use of those lands is a <u>privilege</u> granted by society through government, not a <u>right</u>
4.46 Conflicts sometimes emerge between <u>private</u> land-use rights and the maintenance of environmental quality for the general public
4.47 Man uses planning and zoning methods to define and adjust proper land use because some land or human uses exclude others while some can coexist

5.0 EQUIP STUDENTS WITH SUFFICIENT KNOWLEDGE AND SKILLS THAT THEY MAY INTELLIGENTLY PREDICT AND EVALUATE THE IMPACT OF A SPECIFIC MANAGEMENT POLICY ON THE FOREST ENVIRONMENT AND ITS INTERDEPENDENT COMMUNITIES
5.1 Natural resources are interdependent and the use or misuse of one will affect others
5.11 The exhaustion of one resource produces new demands on others
5.12 The renewable resource base can be extended by research and development, improved conservation practices and management
5.121 The more efficient use of some resources is a result of technical and marketing improvement and changes in consumer-use patterns
5.2 Most resources are vulnerable to depletion in quantity and/or quality
5.21 Plants, including trees, are renewable resources within given limits of utilization
5.22 Wildlife is a renewable resource provided species' populations are maintained above the minimum number necessary for reproduction and suitable habitat is available
5.23 Soil is classified as a renewable resource, but, because it may take a few years to a few thousand years to be "renewed," it is more practically termed a <u>depletable</u> resource
5.24 Water is a <u>reusable</u> and transient resource, but the available quantity may be increased or reduced and/or quality impaired or improved through use
5.25 Minerals are non-renewable resources and are finite in quantity, but can be reused many times in many forms
5.3 Regions of forest and forest activity are interdependent with metropolitan regions and therefore each depends upon the other for its existence
5.4 Some forest <u>values</u> can coexist with other forest <u>uses</u> while others are not compatible either temporally and/or spatially
5.5 All decision making involving natural resources entails the consideration of economic and environmental tradeoffs

6.0 PROVIDE THE STUDENT WITH A BASIC UNDERSTANDING OF HOW THE LIFE-SUPPORT SYSTEM OF PLANET EARTH FUNCTIONS AND HAVE THE NECESSARY SKILLS AND KNOWLEDGE TO EVALUATE THE SHORT-TERM AND MORE IMPORTANTLY THE LONG-RANGE EFFECTS THAT MANIPULATIONS OF SEGMENTS OF THIS SYTEM WILL HAVE ON ITS INTEGRITY

- 6.1 Biological systems are described as dynamic because the materials and energy involved are parts of continuous cycles; inorganic materials and energy become part of organic materials and subsequently broken down into simpler substances and energy as a result of the operation of organic systems
  - 6.11 The forest is a dynamic community composed of living and non living things and dominated by trees
    - 6.111 Matter is for all practical purposes finite and is recirculated continuously by such bio-geo-chemical interactions as:
      - a. the carbon cycle
      - b. the nitrogen cycle
      - c. the mineral (rock) cycle
      - d. the hydrologic (water) cycle
    - 6.112 The ultimate source of energy used by all living systems is the stellar system, primarily the sun
      - 6.1121 Energy is passed unidirectionally through systems and is rapidly dissipated according to the laws of thermodynamics
      - 6.1122 Energy is supplied to an ecosystem through the photosynthetic activities of green plants
      - 6.1123 Green plants are the ultimate source of food, clothing, shelter and energy in most societies
- 6.2 All living things are undergoing constant change through genetic variability and evolutionary development
  - 6.21 The environment is undergoing constant natural change at varying rates of speed due to such factors as:
    - a. weathering and erosion
    - b. elevation and subsidence
    - c. sedimentation
    - d. volcanism
  - 6.22 All living things change in response to environmental change either through adaption or elimination (extinction)
    - 6.221 Succession is the gradual and continuous replacement of one kind of plant or animal complex by another and is characterized by a gradual change in species composition
    - 6.222 The most stable communities are those with the greatest diversity
  - 6.23 Man has been an important factor affecting plant and animal succession and environmental processes
- 6.3 Living things are interdependent with one another and their environment
  - 6.31 Man is an integral part of the biosphere and is constantly affecting it and being affected by it
  - 6.32 Heredity and environment interact to determine the characteristics of an organism, and therefore, a population
- 6.4 All living things have certain basic needs, such as air, water, food, shelter and a suitable climate
  - 6.41 All living things depend on their environment to meet their basic needs
  - 6.42 The size of population that any environment can support in any given period of time is limited. Such a carrying capacity of an area is dependent upon the the availability and distribution of food, water, shelter and space and the extent to which an organism is able to alter its environment to meet its needs
    - 6.421 In any environment, one component such as water, food, shelter or air may become a limiting factor. When these or other resources are in short supply, or in excess to the tolerance of an organism they are said to be limiting factors
  - 6.43 Forests exist under a specific set of conditions although these conditions may vary greatly
  - 6.44 Some lands are currently better suited for the growing of forests than for other uses
- 6.5 Pollutants and contaminants are produced by natural and man-made processes
- 6.6 The biosphere is irreplacable
- 6.7 Man's understanding of the dynamics of the forest and other environments while increasing is far from complete

7.0 PROVIDE STUDENTS WITH THE SKILLS AND KNOWLEDGE TO EVALUATE AND MODIFY THEIR OWN LIFESTYLES IN LIGHT OF AN ACUTE AWARENESS OF THE FINITENESS OF PLANET EARTH

- 7.1 The culture of a group is its learned behavior in the form of customs, habits, attitudes, institutions and lifestyles that are transmitted to its progeny
  - 7.11 The management of natural resources is culture bound
  - 7.12 Supply and demand in relation to the values and needs held by society determines what things are resources and their economic value
    - 7.121 A person's needs are often different from his wants and desires
    - 7.122 Human needs and desires are generally greater than the supply of natural resources available to meet them
      - 7.1221 Choices between needs (essentials) and wants or desires (non essentials) may come into conflict more frequently as humankind's population and consumption levels rise within finite resource limits
    - 7.123 Every human activity has an effect upon our environment and the need to weigh degrading activities against the benefits received becomes increasingly important as population and consumption levels rise within finite resource limits

7.2 Increased population, mobility and affluence are changing the nature of demands on natural resources
  7.21 Changes in the cultural patterns, social and economic values and mores of a society affect the demand for natural resources through their impact on personal conservation practices
    7.211 Ready transportation, coupled with growing interest, money surpluses and increased leisure time combined to create heavy pressures on existing forest recreation facilities and demands for new ones
      7.2111 Some forms of transportation have considerably greater impact on the forest environment than others
        7.21111 Certain emissions from the internal combustion engine have adverse effects on the forest environment
        7.21112 Road construction and right-of-ways for utilities withdraw substantial areas from the production of other forest uses and values
      7.2112 Some forms of leisure-time activities have a greater impact on the forest than others
7.3 Resource depletion and environmental degradation can be slowed by the development and adoption of alternative lifestyles and social expectations
  7.31 Modest changes in consumer preferences and practices can markedly affect the impact of the home and family on the forest environment
  7.32 Modest changes in product design, planning and manufacturing (shop) practices can markedly influence the conservation of natural resources
7.4 The creative expression of one's relationship with nature is a significant and satisfying means of clarifying that relationship

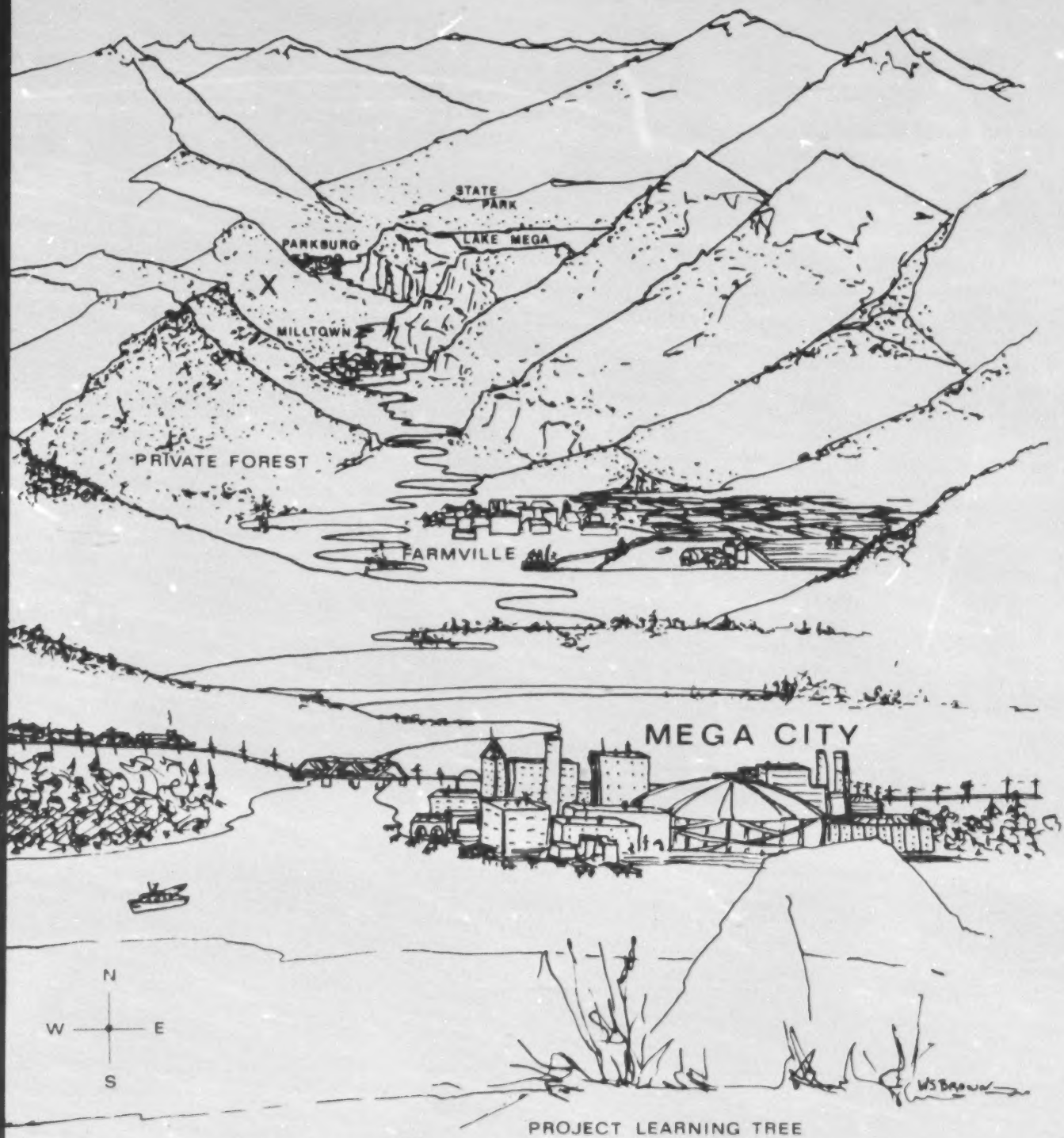
Intellectual and Valuing Skills

Assumed Under PLT Program Principles 4-7

I. The Acquisition and/or Verification of Information Includes:
  Observation
  Data Collection (including library skills)
  Classification
  Interpretation
  Inference
  Extrapolation
  Hypothesis construction and testing
  Theory construction and testing (both content and validity)
  Prediction
II. Communication
III. Effective Social (group) Participation
IV. Critical Thinking
V. Creative Problem Solving
VI. Valuing skills which assist the child in the processes of recognizing and clarifying problems and in managing and/or resolving them

APPENDIX E

Elementary Test Instrument


STATE
PARK
LAKE MEGA
PARKSBURG
X
MILLTOWN
PRIVATE FOREST
FARMVILLE
MEGA CITY
N
W
E
S
PROJECT LEARNING TREE

PROJECT LEARNING TREE

INSTRUCTIONS

The map on the front page of this test is of a make-believe valley called the Mega Valley (there is no real Mega Valley). Many of the questions in this test will ask what you think may be true about the cities, farmlands and forests of the valley. In answering these questions, you will have to decide what is most likely to be true about the Mega Valley based on what you know about your own and other towns or cities.

The Mega Valley starts at Mega City which is a large urban city on the banks of a river large enough for ocean-going ships. A small river called the Mega River runs through the valley from the state park, past the farm lands near Farmville until it joins the big river at Mega City. The other towns in the Mega Valley are Milltown, a small town in the forests; Farmville, a medium-sized town in the farming area; and Parkburg, a small community at the entrance to the state park.

The first 30 questions in the test are true-false questions. If you think a statement is probably true, mark in the space next to T on your answer sheet. If the statement seems false to you, mark in the space next to F. (Following the 30 true-false questions are a few items which ask your opinion about some uses of the forest. Read the directions for these questions when you get to them.)

TRUE-FALSE QUESTIONS

1. The first pioneer settlement in the Mega Valley was probably a fishing village where Milltown now stands.

2. The way the land has been used in the Mega Valley is probably the result of long-term planning.

3. Parkburg would probably have fewer tractor salespeople than either Farmville or Milltown.

4. The Native Americans (Indians) who originally lived where Mega City is now were probably loggers.

5. The cities and towns in the Mega Valley are probably built in places where there were originally few trees.

6. Trees which grow in Mega City now are probably the same kind as grow in the forest areas.

7. The people who live in Mega City probably have more open space for recreation than for commercial development.

8. Parks in Mega City, Farmville and Milltown probably take up around 25% (one-fourth) of the land in those communities.

9. Building a big ski resort near Milltown would probably decrease the amount of silt in the Mega River.

10. Nearly everyone in Farmville probably supported building a better road through the Mega Valley.

11. A forest fire in the mountains could kill many fish in the Mega River.

12. The forest community would be healthier if the bugs were eliminated.

13. Cutting down some trees would help others grow larger.

14. Although squirrels get their food in trees, they usually stay on the ground where they are safe from predators.

15. Almost all trees cut in the forest go into the building of new homes.

16. Trees are important to help hold the topsoil in the forests.

17. Cardboard is made from trees.

18. Glass is made from trees.

19. If fewer trees were cut in the forests, the price of lumber would go up.

20. Some uses of the forest community cannot fit together.

21. Some workers at a paper factory and a box factory would lose their jobs if fewer trees were cut in the forest.

22. Doing something to help one kind of animal in the forest usually has little or no effect on other animals.

23. Paper that cannot be reused can usually be recycled.

24. Pads of white paper are the best source of scratch paper.

25. Wrapping paper can only be used once because it is folded and taped.

26. Many of the things thrown away in school could be reused for some purpose.

27. Pencils can easily be recycled to make new pencils.

28. If nails could be cheaply produced out of wood, they would probably replace the steel ones.

29. If light weight is important, aluminum products often are better than wood products.

30. Metal pencils are made from a renewable resource while wooden pencils are not.

INSTRUCTIONS

In the last four items we ask for your opinion. Next to the item number, you will find four statements about an important issue. Read all of the statements and decide which of them comes closest to your own opinion about that issue. You may think that more than one of the four is true, but try to pick out the one which best represents how you feel. Mark on the answer sheet next to the item number the letter corresponding to your choice.

MULTIPLE-CHOICE QUESTIONS

31. Recreation and growing trees--

a) Growing trees for lumber and other forest products is the only important use of the forest.

b) Recreation is one use of the forest but should not interfere with growing trees for wood.

c) Using the forest for recreation is equally important to using the forest for growing trees.

d) Most forest land should be set aside for recreation.

32. Forest hiking and camping--

a) Most of the forest should be closed to hiking and camping.

b) Hiking and camping should only be allowed in special areas.

c) A large part of the forest should have trails and campgrounds.

d) All of the forests should be open for camping and hiking.

33. Influencing decisions about the use of land--

a) People have no way of influencing decisions about the use of land.

b) People can let their opinions be known, but they have only small effects on decisions.

c) If people let their opinions be known, they can have an effect on decisions.

d) When people bother to let others know what they think, they can greatly influence decisions about the use of land.

34. Supply of trees and wood--

a) There is an unlimited supply of trees for our needs.

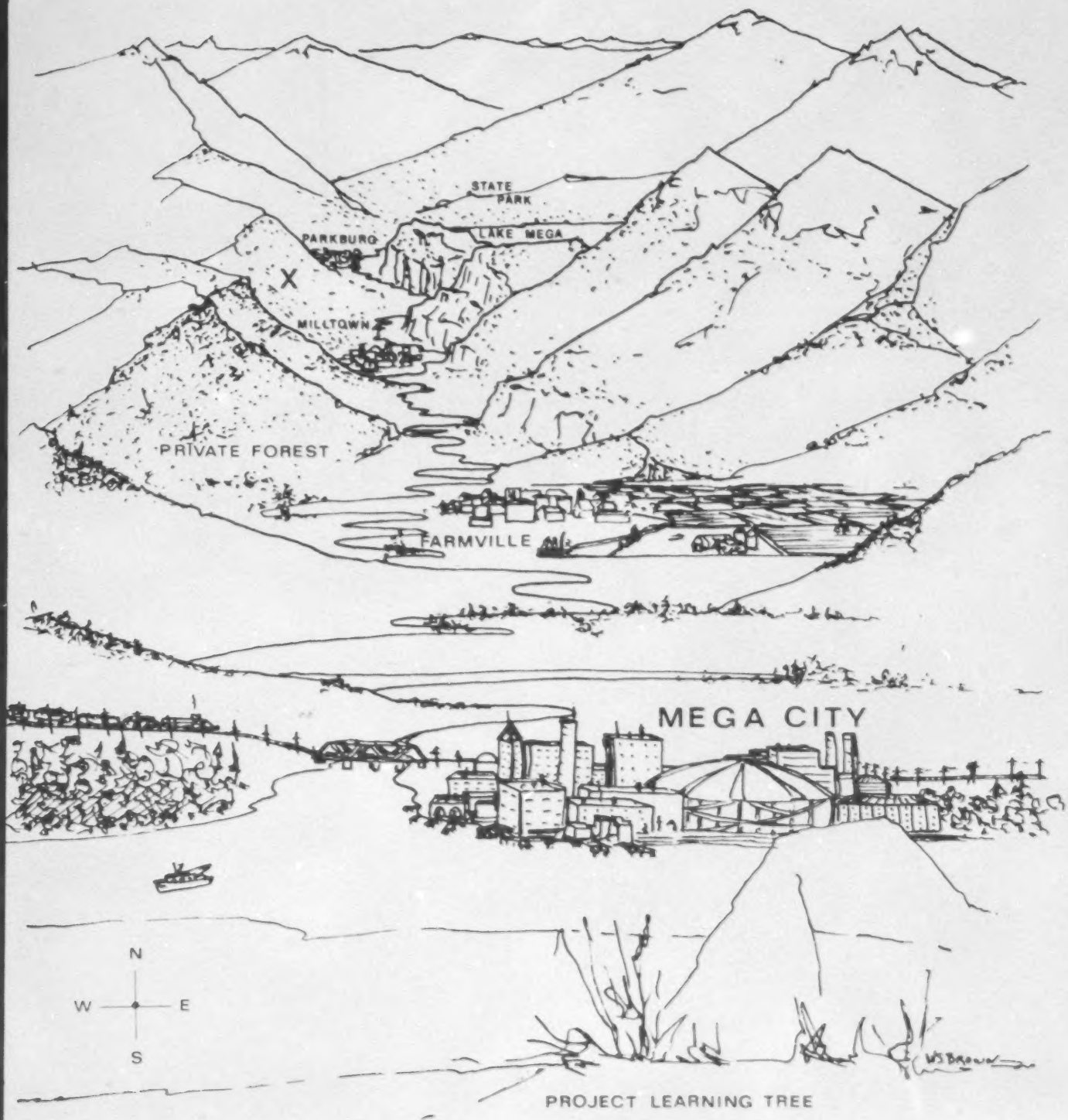
b) At present, there are enough trees to meet present demands.

c) With special care, we can avoid a wood shortage in the near future.

d) Our forests won't have enough trees to meet our needs for wood in the near future.

APPENDIX F

Secondary Test Instrument


STATE
PARK
LAKE MEGA
PARKBURG
X
MILLTOWN
PRIVATE FOREST
FARMVILLE
MEGA CITY
N
W
E
S
PROJECT LEARNING TREE

PROJECT LEARNING TREE

INSTRUCTIONS

The map on the front page of this survey is of a make-believe valley called the Mega Valley (there is no real Mega Valley). Many of the questions in this test will ask what you think may be true about the cities, farmlands and forests of the valley. In answering these questions, you will have to use what you know about your home area and what you guess must be true from the limited information provided on the map. Obviously, there is no real "correct" answer, but rather the answer you think is most likely to be correct.

The valley starts at Mega City which is located on a large river suitable for ocean-going ships. A smaller river runs through the valley joining the larger river at Mega City. The map can be divided into four major areas:

a) Forest areas (private forests, national forests and the state park).

b) Farming areas (around the town of Farmville).

c) Urban areas (around Mega City).

d) Lake and river areas (from Lake Mega along the river to Mega City).

For the first seven questions, mark next to the appropriate item number on your answer sheet the letter corresponding to one of the four major areas listed on the previous page in which each of the following would most likely be found. [For example, #1, hemlock trees, are generally found in forest areas. A few may be located in the farming, urban, and lake and river areas, but they are mainly thought of as trees of the forest. So, answer a, forest area, is correct. Mark a on your answer sheet next to #1.]

Now, indicate the appropriate area (a) Forest areas, (b) Farming areas, (c) Urban areas, or (d) Lake and river areas, for each of the following:

MULTIPLE-CHOICE QUESTIONS (REGARDING FOUR MAJOR AREAS)

1. Hemlock trees
2. Alfalfa
3. Fruit trees
4. Pine trees
5. Willow trees
6. Area with highest average rainfall
7. Area with highest production of carbon dioxide

INSTRUCTIONS

A development group has asked permission to build a multi-million dollar ski resort and summer all-purpose resort in the Mega Valley on private timberland near the state park (at the X on your map). At present, there is only a small skiing area in the valley. Questions #8 through #12 concern this proposed resort. Mark the answer you think is correct for each item on your answer sheet next to the proper question number.

MULTIPLE-CHOICE QUESTIONS (REGARDING PROPOSED RESORT)

8. The largest number of skiers who would use the resort would probably be from:

   a) Parkburg--a small town primarily serving the state park and Lake Mega.

   b) Milltown--a lumber-oriented community of over 3,000 people.

   c) Farmville--a farming community on the Mega River, population 21,300.

   d) Mega City--an urban area with a population of 115,000.

9. Which of the following communities would be most changed in the next five years if the resort were established?

   a) Parkburg

   b) Milltown

   c) Farmville

   d) Mega City

10. Sawmill operators in Milltown would probably:

    a) Favor development because they would have to cut down the forest to make way for the ski runs.

    b) Not be in favor because it would result in more traffic and congestion which would get in the way.

    c) Not be in favor because in the future there would be less forest to harvest.

    d) Have mixed feelings because there is some good and some bad in the project.

11. Which of the following people in Farmville would probably be most financially helped by the proposed project?

    a) The newspaper reporters.

    b) The gas station operators.

    c) The farm machine salespeople.

    d) The Farmville school teachers.

12. The lumber people, the resort developers, and the citizen groups might disagree about whether the resort should be built. In coming to a final decision, it should be remembered that:

    a) All uses of the forest can peacefully coexist.

    b) Development of forest areas does not have much effect on other adjacent areas.

    c) Some uses of the forest simply do not fit together and one excludes the other.

    d) Forest regions are meant for people to use.

INSTRUCTIONS

Questions #13 through #38 are multiple-choice items. Mark the option which is most reasonable. Be sure to mark your answer on the answer sheet next to the correct question number.

MULTIPLE-CHOICE QUESTIONS (GENERAL)

13. If the winds usually come from the west in the Mega Valley, the driest forest area would be:

    a) In the forest on the west side of the valley above Farmville.

    b) In the forest in the north of the valley behind the state park.

    c) In the forest on the east side of the valley.

    d) Equally spread throughout the valley.

14. Several years ago, a new highway was built from Farmville to Mega City. When it was built, the attitudes of the citizens of Farmville towards this change were probably:

    a) Almost all positive since it provided better transportation.

    b) Neutral since most of them didn't go to Mega City very often.

    c) Almost all negative since it cost a lot of money and disturbed the forests.

    d) Mixed, with many people in favor and many people opposed to the change.

15. The population at Farmville has doubled in the last ten years. Most of these newcomers probably live:

a) In old houses in the residential sections of Farmville.

b) In new houses on land that was previously farmland.

c) On farms at the edge of the town.

d) In new houses built in the old residential sections of town.

16. Which of the following represents a probable trend in the use of the farmlands to the east of Farmville?

a) They are being divided up into small farms run by families.

b) They are being converted to forest land by planting trees.

c) They are being bought up by real estate investors.

d) They are being abandoned because they are not near the main highway.

17. In Farmville, there is an old city park located next to a new cement factory on the bank of the Mega River. These two are probably located near one another because:

a) Factory workers need recreational facilities.

b) The factory owners probably gave the land for the park to the city.

c) The factory moved into a residential area to be near the workers' homes.

d) The park happened to be built near an undiscovered limestone deposit.

18. Around the house, several items which used to be made out of wood are now made out of something else. Of the following four examples, pick the use which required the greatest overall increase in energy consumption:

    a) Substitution of synthetic wall-to-wall carpeting for hardwood floors.

    b) Substitution of storm doors for wood sashes.

    c) Substitution of stucco walls for wood siding.

    d) Substitution of vinyl wallcovering for wallpaper.

19. In deciding whether to harvest a section of timber, divert a riverbed, or otherwise change the environment, it is important to remember that:

    a) Natural resources are interdependent and the use or misuse of one affects the others.

    b) The exhaustion of one resource produces increased demand on others.

    c) Natural resources usually affect one another in groups of three; so, the change in one will affect two others.

    d) As some resources are unfavorably affected by a change, others will tend to balance it out by being positively affected.

20. Using reusable glass containers rather than paper cartons for milk would result in:

    a) Fewer natural resources being used.

    b) More energy being used.

    c) More solid waste being produced.

    d) Fewer jobs for milk distributors.

21. In the past, what has been the relationship between short-term economic needs and long-term land use and resource planning?

    a) Most decisions were made for short-term economic gain.

    b) A fair balance was found between economic needs and the long-term effects.

    c) Decisions on specific projects were usually made based on a long-term plan.

    d) Long-term plans made about the use of forest lands have prevented the introduction of commercial and recreational concerns.

22. Which of the following changes would create the most new factory jobs?

    a) Metal outdoor furniture replacing wooden outdoor furniture.

    b) Fiberglass boats for wood boats.

    c) Gas-burning camp stoves for campfires.

    d) Metal tennis racquets for laminated wood racquets.

23. The drive-in, fast-food restaurants are different from other places where you can buy and eat food because they use much more:

    a) Lumber

    b) Water

    c) Paper

    d) Labor

24. Grocery store owners have decided to try to reduce the consumption of paper products by asking their customers to bring their own shopping bags. A probable important outcome of this practice would be:

a) Many people would forget to bring their bags and would need new ones.

b) The amount of electricity consumed by the grocery stores would decrease.

c) There would be more solid waste.

d) Some people in the manufacturing and sales fields would lose business.

25. Logging has generally increased during the past thirty years. This increase is probably related to changes in attitudes toward:

a) Forest fires.

b) Environmental awareness.

c) Pollution.

d) Forest products.

26. To reduce the amount of forest products consumed without significant side effects, rather than using a new paper sack each day, people could:

a) Carry a lunch pail.

b) Eat at a drive-in restaurant.

c) Drive home for lunch.

d) Eat a big breakfast and skip lunch.

27. Using aluminum outdoor furniture rather than wood outdoor furniture has the disadvantage of:

a) Using nonrenewable natural resources.

b) Having a higher retail cost.

c) Providing less flexibility in design.

d) Weighing more and being harder to move.

28. Compared to 25 years ago, which of the following uses of land in populated areas has had the greatest increase?

a) Park lands.

b) Shopping centers.

c) Industrial areas.

d) Schools and government offices.

29. Use of which of the following wrapping materials would most reduce the use of nonrenewable resources?

a) Using paper rather than cellophane.

b) Using aluminum rather than most plastics.

c) Using most plastics rather than cellophane.

d) Using cellophane rather than most plastics.

30. Which of the following statements represent the most significant environmental concern in using a starter fluid to start a barbeque?

a) The starter fluid usually has a bad smelling smoke.

b) The starter fluid uses nonrenewable resources.

c) The starter fluid makes the food taste different.

d) The starter fluid takes less time to produce a fire.

31. To what extent are products of the forest important today?

    a) Most people in their daily lives rely on a large number of products of the forest.

    b) Products of the forest are much less important than they were before plastics were invented.

    c) Almost everything that people use in their daily lives are products of the forest.

    d) Products of the forest are mainly important for construction of new houses.

32. Which of the following do foresters most often alter in order to grow larger trees?

    a) The amount of rainfall the trees receive.

    b) The amount of weedkiller the area receives.

    c) The amount of light the trees receive.

    d) The amount of wildlife present in the forest.

33. Which of the following trees would grow best in an area which receives little rainfall?

    a) Ponderosa pine.

    b) Sitka spruce.

    c) Redwood.

    d) Red cedar.

34. One of the first renewable resources from the Western United States was:

    a) Wheat and grain.

    b) Coal.

    c) Timber.

    d) Gold.

35. Which of the following forest types is best suited for growing hardwoods?

    a) Southwestern.

    b) Northern.

    c) Rocky Mountain.

    d) Pacific Coast.

36. In the Southeastern part of the United States, the forests are mostly:

    a) Pine trees.

    b) Douglas fir.

    c) Birch and maple.

    d) Magnolias.

37. Which best describes the area in which you will find the most Douglas firs?

    a) Pacific Coast.

    b) Rocky Mountains.

    c) Northern forests.

    d) Throughout the United States.

38. Which of the following items is NOT primarily a wood product?

    a) Particle board.

    b) Pencils.

    c) Cardboard.

    d) Burlap bags.

INSTRUCTIONS

The remainder of the questionnaire concerns opinions and attitudes concerning a number of important issues about the forests. Each item number consists of five statements about a common issue. You are to read each of the five statements and decide which one you agree with most. You may think that more than one is true, but try to pick the one which is the most like your own opinion. Mark the choice on the answer sheet next to the item number.

OPINION AND ATTITUDE QUESTIONS

39. a) Forests should be managed by the Federal government.

b) The government ought to manage most of the forest with part being in the hands of private companies.

c) Forest management should be equally divided between private companies and the government.

d) Large sections of the forest ought to be managed by private companies with the government managing forest lands mainly for recreation and water-shed.

e) The government ought to get out of forest management.

40. a) The only important function of forest land is to produce wood and wood fibers. Other uses must not be allowed to interfere with this function.

b) Recreation is one function of forest land but should not get in the way of wood production.

c) Recreation is equally important to wood production. Space must be made in forest lands for both.

d) Recreational uses of forest land are more important than the wood produced. All decisions concerning the forest land should be strongly based upon the impact it would have on recreational use.

e) Forest land should be for the exclusive use of people for recreation. Wood production should not be allowed to interfere with this function.

41. a) The public should be allowed to use all publicly-owned lands for hiking and camping.

b) The public should be restricted to camps and small well-controlled parts of publicly-owned forest land.

c) All forest lands, both public and private, should be open to the public with roads and trails for easy access.

d) A large part of the public forests and private forests should be restricted so that people cannot camp on them.

e) All forest lands should be open to all people, but some parts should be very difficult to get to.

42. a) Private citizens have no way of influencing decisions concerning the use of the forests.

b) Citizens can sometimes get their opinions heard, but they can only have a small impact.

c) People can sometimes influence decisions by letting others know their opinions.

d) Private citizens can have considerable impact on decisions concerning the forest if they let people know what they think.

e) Input from private citizens is one of the most important pieces of information in any decision concerning the forests.

43. a) The forests have almost unlimited quantities of wood and wood fiber waiting to be used.

b) There is plenty of wood for current and predicted need for years to come.

c) If people are careful, there should be enough wood products for the future.

d) If special precautions are not taken, we could soon be in a wood shortage situation.

e) Our forests cannot possibly provide enough wood for our present and future needs.

APPENDIX G

List of Participants by City and State in the Treatment Group

PROJECT LEARNING TREE

LIST OF PARTICIPANTS

Elementary Treatment Group

CITY/STATE	TYPE OF COMMUNITY	LUMBER/NON-LUMBER	GRADE LEVEL	NO. OF STUDENTS
Orafino, ID	Town	Lumber	4-5-6	26
Sedro Woolley, WA	"	"	"	25
Stayton, OR	City	"	"	26
Boise, ID	Suburban	"	"	52
Stayton, OR	Town	"	"	43
Cambridge, ID	"	"	"	15
Onalaska, WA	"	"	"	34
Tucson, AZ	Urban/Metro	"	"	34
Fruitland, ID	Suburban	"	"	23
Weippe, ID	Town	"	"	37
Brooks, OR	"	"	"	10
Ontario, OR	"	Non-Lumber	"	19
Rufus, OR	"	"	"	9
Riddle, OR	"	"	"	34
Reno, NV	City	"	"	30
Phoenix, AZ	Urban/Metro	"	"	58
Fallon, NV	Other	"	"	28
Salt Lake City, UT	Suburban	"	"	30
Hawthorne, NV	City	"	"	22
Yerington, NV	Town	"	"	26
Tucson, AZ	Suburban	"	"	31
Orem, UT	City	"	"	27
Salt Lake City, UT	Suburban	"	"	10

Elementary Treatment Group (Cont.)
Page 2

CITY/STATE	TYPE OF COMMUNITY	LUMBER/NON-LUMBER	GRADE LEVEL	NO. OF STUDENTS
Longmont, CO	Suburban	Non-Lumber	4-5-6	20
Milliken, CO	Town	"	"	23
Hardin, MT	"	"	"	11
Moro, OR	"	"	"	11
Moscow, ID	City	"	"	25
Moscow, ID	"	"	"	24
Salt Lake City, UT	Suburban	"	"	50
Alameda, CA	City	"	"	85
Alameda, CA	"	"	"	51
Salt Lake City, UT	Suburban	"	"	28
TOTAL ELEMENTARY TREATMENT GROUP:				977

PROJECT LEARNING TREE

LIST OF PARTICIPANTS

Secondary Treatment Group

CITY/STATE	TYPE OF COMMUNITY	LUMBER/NON-LUMBER	GRADE LEVEL	NO. OF STUDENTS
Des Moines, WA	Suburban	Lumber	10-12	22
Lewiston, ID	City	"	7-9	43
Lakeview, OR	Town	"	7-9	11
Silver Lake, OR	"	"	7-9	18
Emmett, ID	"	"	7-9	89
			10-12	50
Deary, ID	"	"	7-9	31
			10-12	26
Elk River, ID	"	"	7-9	7
Las Vegas, NV	Urban/Metro	Non-Lumber	7-9	21
			10-12	10
Salt Lake City, UT	"	"	10-12	30
Salt Lake City, UT	"	"	10-12	130
Phoenix, AZ	Suburban	"	7-9	120
Fremont, CA	"	"	10-12	32
Lodi, CA	City	"	7-9	137
Orem, UT	"	"	10-12	16
Keensburg, CO	Town	"	7-9	97
Arock, OR	"	"	7-9	7
Moro, OR	"	"	7-9	11
Wells, NV	"	"	7-9	29
Rock River, WY	"	"	10-12	23
Tucson, AZ	Other	"	7-9	39
TOTAL SECONDARY TREATMENT GROUP:				999

APPENDIX H

List of Participants by City and State in the Control Group

PROJECT LEARNING TREE

LIST OF PARTICIPANTS

Elementary Control Group from Washington

CITY	TYPE OF COMMUNITY	LUMBER/NON-LUMBER	GRADE LEVEL	NO. OF STUDENTS
Bellevue	Suburban	Lumber	4-5-6	47
Onalaska	Town	"	"	26
Everett	Urban/Metro	"	"	112
Everett	"	"	"	62
Coupeville	Town	Non-Lumber	"	85
Castle Rock	"	"	"	55
Oak Harbor	City	"	"	61
Gig Harbor	Town	"	"	77
Bellingham	"	"	"	24
Kennewick	City	"	"	70
Wenatchee	"	Lumber	"	47
TOTAL WASHINGTON ELEMENTARY CONTROL STUDENTS:				666

PROJECT LEARNING TREE

LIST OF PARTICIPANTS

Secondary Control Group from Washington

CITY	TYPE OF COMMUNITY	LUMBER/NON-LUMBER	GRADE LEVEL	NO. OF STUDENTS
Seattle	Urban/Metro	Lumber	7-9	103
Seattle	"	"	7-9	1
			10-12	22
Seattle	"	"	10-12	27
Longview	City	"	7-9	67
Onalaska	Town	"	7-9	24
Bainbridge	"	"	7-9	2
			10-12	73
Seattle	Urban/Metro	Non-Lumber	7-9	25
Seattle	"	"	7-9	50
Edmonds	Suburban	"	7-9	37
Edmonds	"	"	7-9	126
Renton	"	"	7-9	135
Bainbridge	"	"	7-9	32
Oak Harbor	City	"	7-9	72
Oak Harbor	"	"	7-9	51
Kennewick	"	"	7-9	87
Kent	"	"	10-12	89
Coupeville	Town	"	7-9	39
Coupeville	"	"	10-12	55
Bellingham	"	"	7-9	29
Bainbridge	"	"	7-9	15
			10-12	5
Silverdale	Other	"	10-12	88
TOTAL WASHINGTON SECONDARY CONTROL STUDENTS:				1,254

PROJECT LEARNING TREE

LIST OF PARTICIPANTS

Control Group from California

CITY	TYPE OF COMMUNITY	LUMBER/NON-LUMBER	GRADE LEVEL	NO. OF STUDENTS
Whittier	Urban/Metro	Non-Lumber	4-5-6	25
Carmichael	Suburban	"	"	26
Covina	"	"	"	32
Covina	"	"	10-12	87
Fair Oaks	City	"	7-9	8
			10-12	15
TOTAL CALIFORNIA CONTROL STUDENTS				193

APPENDIX I

Elementary Grade Results on Each Individual Item in the Test

PROJECT LEARNING TREE

Elementary Group Summary of Scores

	Percent Correct	
	Treatment	Control
1. The first pioneer settlement in the Mega Valley was probably a fishing village where Milltown now stands.	41%	42%
2. The way the land has been used in the Mega Valley is probably the result of long-term planning.	32	36
3. Parkbury would probably have fewer tractor salespeople than either Farmville or Milltown.	76	73
4. The Native Americans (Indians) who originally lived where Mega City is now were probably loggers.	79	76
5. The cities and towns in the Mega Valley are probably built in places where there were originally few trees.	35	36
6. Trees which grow in Mega City now are probably the same kind as grow in the forest areas.	51	48
7. The people who live in Mega City probably have more open space for recreation than for commercial development.	47	55
8. Parks in Mega City, Farmville and Milltown probably take up around 25% (one-fourth) of the land in those communities.	43	51
9. Building a big ski resort near Milltown would probably decrease the amount of silt in the Mega River.	54	49
10. Nearly everyone in Farmville probably supported building a better road through the Mega Valley.	31	33
11. A forest fire in the mountains could kill many fish in the Mega River.	46	42
12. The forest community would be healthier if the bugs were eliminated.	50	48
13. Cutting down some trees would help others grow larger.	62	73
14. Although squirrels get their food in trees, they usually stay on the ground where they are safe from predators.	87	87

		Percent Correct	
		Treatment	Control
15.	Almost all trees cut in the forest go into the building of new homes.	30	27
16.	Trees are important to help hold the topsoil in the forests.	84	74
17.	Cardboard is made from trees.	91	91
18.	Glass is made from trees.	93	93
19.	If fewer trees were cut in the forests, the price of lumber would go up.	79	82
20.	Some uses of the forest community cannot fit together.	64	62
21.	Some workers at a paper factory and a box factory would lose their jobs if fewer trees were cut in the forest.	83	86
22.	Doing something to help one kind of animal in the forest usually has little or no effect on other animals.	60	58
23.	Paper that cannot be reused can usually be recycled.	74	70
24.	Pads of white paper are the best source of scratch paper.	55	42
25.	Wrapping paper can only be used once because it is folded and taped.	79	78
26.	Many of the things thrown away in school could be reused for some purpose.	96	94
27.	Pencils can easily be recycled to make new pencils.	81	80
28.	If nails could be cheaply produced out of wood, they would probably replace the steel ones.	68	73
29.	If light weight is important, aluminum products often are better than wood products.	66	69
30.	Metal pencils are made from a renewable resource while wooden pencils are not.	50	47

Since there was no "correct" answer to the following opinion questions, the percentage listed to the right of each option is the percent of students who responded to each option:

	Percent of Response	
	Treatment	Control
31. Recreation and growing trees--		
a) Growing trees for lumber and other forest products is the only important use of the forest.	10.1%	7.6%
b) Recreation is one use of the forest but should not interfere with growing trees for wood.	33.1	30.7
c) Using the forest for recreation is equally important to using the forest for growing trees.	42.5	46.3
d) Most forest land should be set aside for recreation.	12.1	14.6
No response	2.3	0.8
32. Forest hiking and camping--		
a) Most of the forest should be closed to hiking and camping.	3.6	4.0
b) Hiking and camping should only be allowed in special areas.	48.0	39.1
c) A large part of the forest should have trails and campgrounds.	27.8	32.2
d) All of the forests should be open for camping and hiking.	18.3	23.5
No response	2.3	1.2

	Percent of Response	
	Treatment	Control
33. Influencing decisions about the use of land--		
a) People have no way of influencing decisions about the use of land.	8.0%	8.1%
b) People can let their opinions be known, but they have only small effects on decisions.	15.0	18.4
c) If people let their opinions be known, they can have an effect on decisions.	36.5	33.9
d) When people bother to let others know what they think, they can greatly influence decisions about the use of land.	37.7	38.3
No response	2.8	1.2
34. Supply of trees and wood--		
a) There is an unlimited supply of trees for our needs.	11.2	9.5
b) At present, there are enough trees to meet present demands.	12.4	11.5
c) With special care, we can avoid a wood shortage in the near future.	56.6	60.8
d) Our forests won't have enough trees to meet our needs for wood in the near future.	17.3	17.2
No response	2.6	0.9

APPENDIX J

Secondary Grade Results on Each Individual Item in the Test

PROJECT LEARNING TREE

Secondary Group Summary of Scores

	Percent Correct			
	7-9		10-12	
	T	C	T	C
Indicate the appropriate area (a) forest areas, (b) farming areas, (c) urban areas, or (d) lake and river areas, for each of the following:				
1. Hemlock trees	96%	95%	95%	95%
2. Alfalfa	89	85	95	94
3. Fruit trees	72	78	78	84
4. Pine trees	89	88	89	89
5. Willow trees	49	38	48	45
6. Area with highest average rainfall	43	32	52	49
7. Area with highest production of carbon dioxide	63	66	79	71
Mark the answer you think is correct for each item:				
8. The largest number of skiers who would use the resort would probably be from:	63	55	71	77
a) Parkburg--a small town primarily serving the state park and Lake Mega.				
b) Milltown--a lumber-oriented community of over 3000 people.				
c) Farmville--a farming community on the Mega River, population 21,300.				
d) Mega City--an urban area with a population of 115,000.				
9. Which of the following communities would be most changed in the next five years if the resort were established?	55	53	65	61
a) Parkburg				
b) Milltown				
c) Farmville				
d) Mega City				

	Percent Correct			
	7-9		10-12	
	T	C	T	C
10. Sawmill operators in Milltown would probably:	64%	60%	72%	69%
a) favor development because they would have to cut down the forest to make way for the ski runs.				
b) not be in favor because it would result in more traffic and congestion which would get in the way.				
c) not be in favor because in the future there would be less forest to harvest.				
d) have mixed feelings because there is some good and some bad in the project.				
11. Which of the following people in Farmville would probably be most financially helped by the proposed project?	65	57	80	84
a) The newspaper reporters				
b) The gas station operators				
c) The farm machine salespeople				
d) The Farmville school teachers				
12. The lumber people, the resort developers, and the citizen groups might disagree about whether the resort should be built. In coming to a final decision, it should be remembered that:	31	32	32	37
a) all uses of the forest can peacefully coexist.				
b) Development of forest areas does not have much effect on other adjacent areas.				
c) Some uses of the forest simply do not fit together and one excludes the other.				
d) Forest regions are meant for people to use.				
13. If the winds usually come from the west in the Mega Valley, the driest forest area would be:	31	32	33	38
a) in the forest on the west side of the valley above Farmville.				
b) In the forest in the north of the valley behind the state park.				
c) In the forest on the east side of the valley.				
d) Equally spread throughout the valley.				

	Percent Correct			
	7-9		10-12	
	T	C	T	C
14. Several years ago, a new highway was built from Farmville to Mega City. When it was built, the attitudes of the citizens of Farmville towards this change were probably:	52%	48%	56%	60%
a) almost all positive since it provided better transportation.				
b) neutral since most of them didn't go to Mega City very often.				
c) almost all negative since it cost a lot of money and disturbed the forests.				
d) mixed, with many people in favor and many people opposed to the change.				
15. The population at Farmville has doubled in the last ten years. Most of these newcomers probably live:	47	43	68	65
a) in old houses in the residential sections of Farmville.				
b) in new houses on land that was previously farmland.				
c) on farms at the edge of the town.				
d) in new houses built in the old residential sections of town.				
16. Which of the following represents a probably trend in the use of the farmlands to the east of Farmville?	35	31	50	41
a) They are being divided up into small farms run by families.				
b) They are being converted to forest land by planting trees.				
c) They are being bought up by real estate investors.				
d) They are being abandoned because they are not near the main highway.				
17. In Farmville, there is an old city park located next to a new cement factory on the bank of the Mega River. These two are probably located near one another because:	40	32	50	47
a) factory workers need recreational facilities.				
b) the factory owners probably gave the land for the park to the city.				
c) the factory moved into a residential area to be near the workers' homes.				
d) the park happened to be built near an undiscovered limestone deposit.				

	Percent Correct			
	7-9		10-12	
	T	C	T	C
18. Around the house, several items which used to be made out of wood are now made out of something else. Of the following four examples, pick the use which required the greatest overall increase in energy consumption:	39%	36%	50%	41%
a) Substitution of synthetic wall-to-wall carpeting for hardwood floors.				
b) Substitution of storm doors for wood sashes.				
c) Substitution of stucco walls for wood siding.				
d) Substitution of vinyl wallcovering for wallpaper.				
19. In deciding whether to harvest a section of timber, divert a riverbed, or otherwise change the environment, it is important to remember that:	38	38	46	53
a) Natural resources are interdependent and the use or misuse of one affects the others.				
b) The exhaustion of one resource produces increased demand on others.				
c) Natural resources usually affect on another in groups of three; so, the change in one will affect two others.				
d) As some resources are unfavorably affected by a change, others will tend to balance it out by being positively affected.				
20. Using reusable glass containers rather than paper cartons for milk would result in:	52	47	56	67
a) fewer natural resources being used.				
b) more energy being used.				
c) more solid waste being produced.				
d) fewer jobs for milk distributors.				
21. In the past, what has been the relationship between short-term economic needs and long-term land use and resource planning?	22	24	34	34
a) Most decisions were made for short-term economic gain.				
b) A fair balance was found between economic needs and the long-term effects.				
c) Decisions on specific projects were usually made based on a long-term plan.				
d) Long-term plans made about the use of forest lands have prevented the introduction of commercial and recreational concerns.				

	Percent Correct			
	7-9		10-12	
	T	C	T	C
22. Which of the following changes would create the most new factory jobs?	28%	26%	30%	34%
a) Metal outdoor furniture replacing wooden outdoor furniture.				
b) Fiberglass boats for wood boats.				
c) Gas-burning camp stoves for campfires.				
d) Metal tennis racquets for laminated wood racquets.				
23. The drive-in, fast-food restaurants are different from other places where you can buy and eat food because they use much more:	60	36	66	60
a) lumber				
b) water				
c) paper				
d) labor				
24. Grocery store owners have decided to try to reduce the consumption of paper products by asking their customers to bring their own shopping bags. A probably important outcome of this practice would be:	50	39	46	49
a) many people would forget to bring their bags and would need new ones.				
b) the amount of electricity consumed by the grocery stores would decrease.				
c) there would be more solid waste.				
d) some people in the manufacturing and sales fields would lose business.				
25. Logging has generally increased during the past thirty years. This increase is probably related to changes in attitudes toward:	44	38	56	49
a) forest fires				
b) environmental awareness				
c) pollution				
d) forest products				

	Percent Correct			
	7-9		10-12	
	T	C	T	C
26. To reduce the amount of forest products consumed without significant side effects, rather than using a new paper sack each day, people could:	70%	61%	77%	75%
a) carry a lunch pail				
b) eat at a drive-in restaurant				
c) drive home for lunch				
d) eat a big breakfast and skip lunch				
27. Using aluminum outdoor furniture rather than wood outdoor furniture has the disadvantage of:	26	28	43	40
a) using nonrenewable natural resources.				
b) having a higher retail cost.				
c) providing less flexibility in design.				
d) weighing more and being harder to move.				
28. Compared to 25 years ago, which of the following uses of land in populated areas has had the greatest increase?	35	32	40	44
a) park lands				
b) shopping centers				
c) industrial areas				
d) schools and government offices				
29. Use of which of the following wrapping materials would most reduce the use of nonrenewable resources?	24	19	17	18
a) Using paper rather than cellophane.				
b) Using aluminum rather than most plastics.				
c) Using most plastics rather than cellophane.				
d) Using cellophane rather than most plastics.				
30. Which of the following statements represent the most significant environmental concern in using a starter fluid to start a barbeque?	38	35	49	49
a) The starter fluid usually has a bad smelling smoke.				
b) The starter fluid uses nonrenewable resources.				
c) The starter fluid makes the food taste different.				
d) The starter fluid takes less time to produce a fire.				

	Percent Correct			
	7-9		10-12	
	T	C	T	C
31. To what extent are products of the forest important today?	38%	31%	39%	37%
a) Most people in their daily lives rely on a large number of products of the forest.				
b) Products of the forest are much less important than they were before plastics were invented.				
c) Almost everything that people use in their daily lives are products of the forest.				
d) Products of the forest are mainly important for construction of new houses.				
32. Which of the following do foresters most often alter in order to grow larger trees?	31	36	31	32
a) The amount of rainfall the trees receive.				
b) The amount of weedkiller the area receives.				
c) The amount of light the trees receive.				
d) The amount of wildlife present in the forest.				
33. Which of the following trees would grow best in an area which receives little rainfall?	29	30	37	40
a) Ponderosa pine				
b) Sitka spruce				
c) Redwood				
d) Red cedar				
34. One of the first renewable resources from the Western United States was:	40	39	52	46
a) wheet and grain				
b) coal				
c) timber				
d) gold				
35. Which of the following forest types is best suited for growing hardwoods?	29	33	31	32
a) Southwestern				
b) Northern				
c) Rocky Mountain				
d) Pacific Coast				

	Percent Correct			
	7-9		10-12	
	T	C	T	C
36. In the Southeastern part of the United States, the forests are mostly: a) pine trees b) douglas fir c) birch and maple d) magnolias	33%	22%	26%	18%
37. Which best describes the area in which you will find the most Douglas firs? a) Pacific Coast b) Rocky Mountains c) Northern forests d) Throughout the United States	20	25	24	34
38. Which of the following items is NOT primarily a wood product? a) particle board b) pencils c) cardboard d) burlap bags	68	55	66	67

Since there was no "correct" answer to the following opinion questions, the percentage listed to the right of each option is the percent of students who responded to each option:

		Percent of Response			
		7-9		10-12	
		T	C	T	C
39.	a) Forests should be managed by the Federal Government.	27.1%	25.9%	27.7%	33.3%
	b) The government ought to manage most of the forest with part being in the hands of private companies.	15.9	19.6	19.9	19.8
	c) Forest management should be equally divided between private companies and the government.	18.6	21.7	16.8	18.0
	d) Large sections of the forest ought to be managed by private companies with the government managing forest lands mainly for recreation and water-shed.	19.4	16.4	19.6	17.8
	e) The government ought to get out of forest management.	17.2	14.2	14.9	8.0
	No response	1.8	2.2	1.0	3.0
40.	a) The only important function of forest land is to produce wood and wood fibers. Other uses must not be allowed to interfere with this function.	9.4	8.2	2.4	5.0
	b) Recreation is one function of forest land but should not get in the way of wood production.	30.3	31.3	30.6	24.3
	c) Recreation is equally important to wood production. Space must be made in forest lands for both.	35.8	34.0	47.1	51.1
	d) Recreational uses of forest land are more important than the wood produced. All decisions concerning the forest land should be strongly based upon the impact it would have on recreational use.	13.3	12.3	12.8	8.9
	e) Forest land should be for the exclusive use of people for recreation. Wood production should not be allowed to interfere with this function.	8.8	11.4	5.5	7.2
	No response	2.4	2.8	1.6	3.5

		Percent of Response			
		7-9		10-12	
		T	C	T	C
41. a)	The public should be allowed to use all publicly-owned lands for hiking and camping.	27.9%	29.1%	26.7%	27.0%
b)	The public should be restricted to camps and small well-controlled parts of publicly-owned forest land.	19.6	17.2	17.0	21.5
c)	All forest lands, both public and private, should be open to the public with roads and trails for easy access.	16.5	18.3	19.1	17.0
d)	A large part of the public forests and private forests should be restricted so that people cannot camp on them.	15.6	17.2	15.7	17.4
e)	All forest lands should be open to all people, but some parts should be very difficult to get to.	17.0	15.1	19.6	14.3
No response		3.4	3.2	1.8	2.8
42. a)	Private citizens have no way of influencing decisions concerning the use of the forests.	7.1	7.8	6.3	6.7
b)	Citizens can sometimes get their opinions heard, but they can only have a small impact.	15.6	23.1	18.8	20.2
c)	People can sometimes influence decisions by letting others know their opinions.	30.5	28.7	30.6	26.7
d)	Private citizens can have considerable impact on decisions concerning the forest if they let people know what they think.	23.5	23.5	21.2	26.1
e)	Input from private citizens is one of the most important pieces of information in any decision concerning the forests.	20.1	14.0	21.5	16.5
No response		3.2	3.0	1.6	3.7

		Percent of Response			
		7-9		10-12	
		T	C	T	C
43. a)	The forests have almost unlimited quantities of wood and wood fiber waiting to be used.	9.7%	11.6%	8.9%	3.9%
b)	There is plenty of wood for current and predicted need for years to come.	9.4	10.1	11.5	7.8
c)	If people are careful, there should be enough wood products for the future.	34.4	34.0	38.7	41.1
d)	If special precautions are not taken, we could soon be in a wood shortage situation.	30.0	26.4	29.6	35.2
e)	Our forests cannot possibly provide enough wood for our present and future needs.	13.6	14.6	9.9	8.5
	No response	2.9	3.3	1.3	3.